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New York:
Thursday, January 9,
1896.

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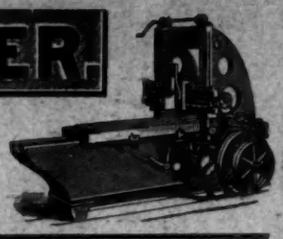

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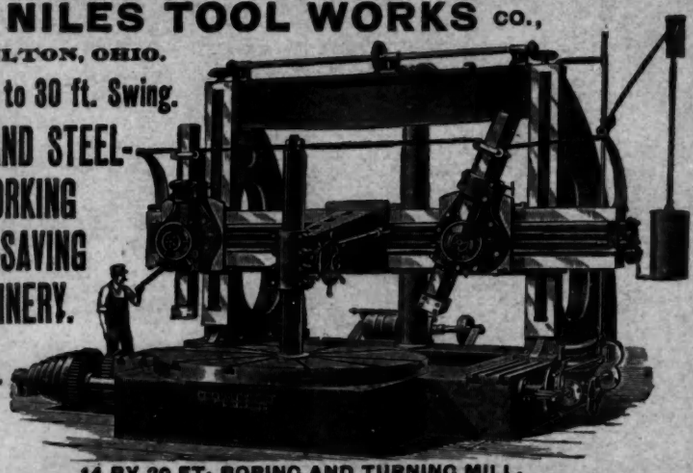

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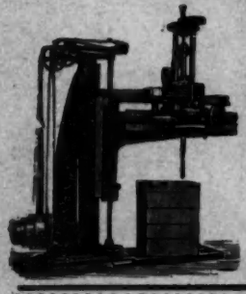

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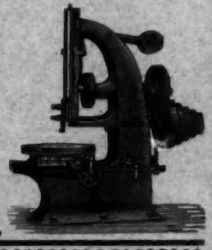

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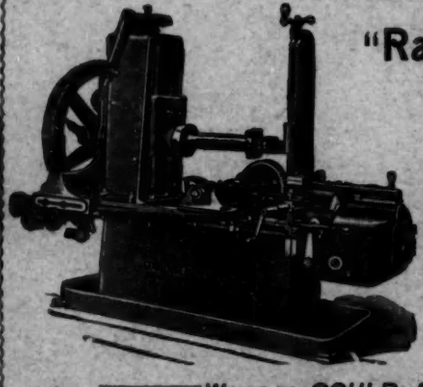

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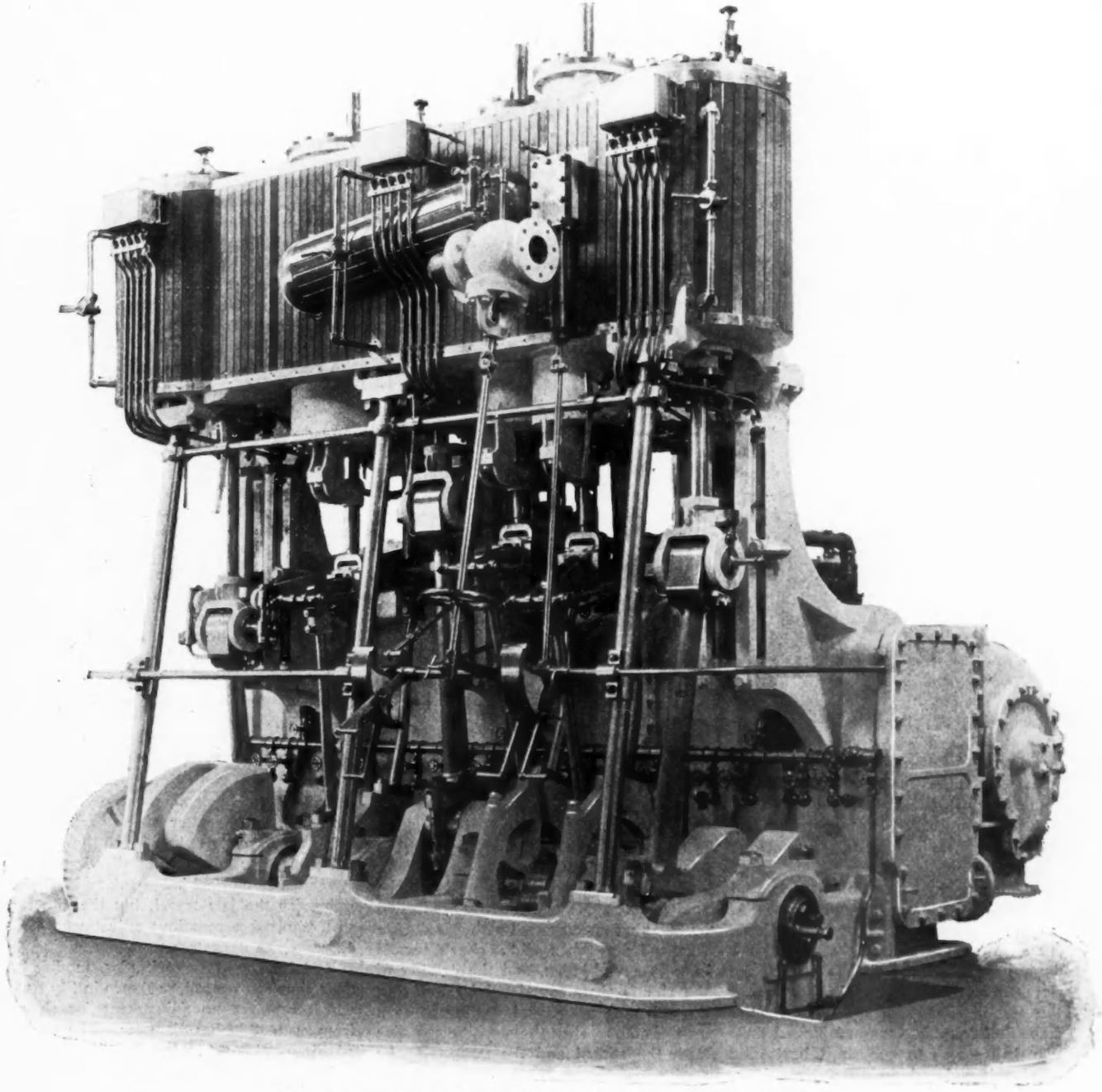


TRIPLE EXPANSION ENGINE FOR YACHT "PEREGRINE."

Triple-Expansion Engine for Yacht "Peregrine."

The triple expansion engine of which we give an illustration was built by the Bath Iron Works, Bath, Me., for the steam yacht Peregrine, designed by C. R. Hanscom, Bath, Me.

The cylinders are 14, 21 and 34½ inches diameter, and 22 inches stroke. Piston valves are used throughout. The high pressure cylinder is placed in the center, the intermediate cylinder is placed forward, and the low pressure cylinder aft. The propeller is of manganese bronze, four-bladed; diameter 8 feet 3 inches, pitch about 10 feet. Steam is furnished by two Almy water tube boilers, built for a working pressure of 185 pounds, occupying a space 83 inches long, 83 inches wide, and 104 inches high. The grate surface is 65 square feet, and the heating surface about 2,500 square feet. The designed indicated horse-power is 800, and this is expected to give the vessel a speed of over 14 knots. The principal dimensions of the hull are: Length over all, 158 feet 3 inches; on low water line, 131 feet; beam, extreme, 23 feet; depth of hold, 13 feet; mean draft, 10 feet; extreme draft, 10 feet 9 inches. The vessel will be lighted throughout by electricity, the dynamo being in the engine room; the vessel will also be fitted with a 12-inch search light, and display lights.

Bicycle Tools—XII.

Rudolpe & Krummel, two graduates from the E. W. Bliss shops, Brooklyn, went to Chicago in 1892 and started a shop of their own, and began to look out hard for work. Hearing that the "Sterling" was in want of a special rim drilling machine (for steel rims of course, as in 1892 the wood rim was yet an unpromising experiment), Mr. Rudolphe called, and learned that the order had already been placed, by mail, in England. Not being easily put aside, Mr. Rudolphe hastened to the drawing board, prepared a sketch of the machine he thought suitable, and went back to the Sterling superintendent, who liked the plan of the machine, and upon Rudolphe's offer to pay for a countermanding cablegram to the English makers, the order was placed with the new home firm of young men, and was filled with the rim driller shown in Fig. 84, from a photograph of the original machine taken in the Sterling shops.

This is a 2-spindle machine, but instead of inclining the rim chuck, after the manner of Fox, Pratt & Whitney, and Pope, and drilling once round the rim with a double space index, and then turning the rim over on the chuck and drilling around the second time with the double space step, Rudolphe & Krummel hinged their two drill stocks to two short horizontal revolvable and end sliding carriers, journaled in sliding brackets, and controlled the inclination of the spindles to front or rear with a pivoted slotted link and holding screw, thus giving the drill spindle stock a universal adjustment for the spindle angle and also an independent adjustment of each drill spindle to and from the vertical axial plane of the chuck. The chuck was of the toggle variety, and required adjustment for each size of rim, on each of its six long-faced chuck jaws. This tool is fairly shown in Fig. 84, and gave great satisfaction. It was the first special rim drilling machine built, and it is now the only 2-spindle machine on the market which can drill two adjacent holes in the rim, and so drill once around only and yet complete the drilling. This distinction is quite an advantage, and is due to the universal spindle angle adjustment. The spindles are wholly independent of each other, and can be adjusted to lean the top backward or forward at pleasure, and

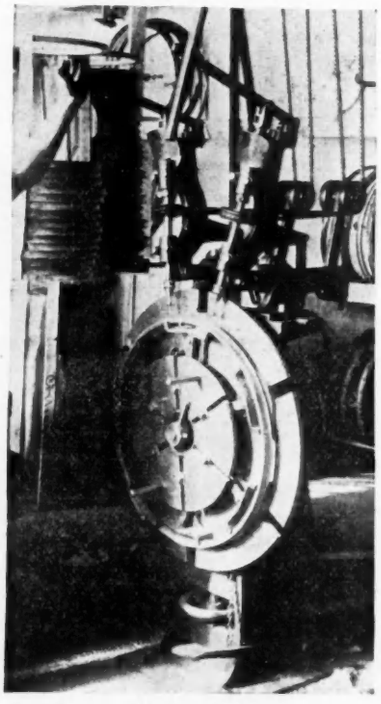


Fig. 84.
RIM DRILL.

so can drill one hole leading to the front axle flange and one spoke hole leading to the rear axle flange, both at the same time. The tangent angle is not commonly regarded in drilling with this machine, and cannot be met if the machine is to drill all the spoke holes in going once round the rim.

If, however, the drills be set twice the spoke space apart, and the rims are drilled by indexing once around with this double step, and then taken off the chuck, turned over to a mid-index, and the drilling of the rim is then completed by indexing around once more, and drilling at each step of course, then the machine can give both the spread and the tangent spoke angles.

I am not at all certain that the tangent angle can be well neglected in rim drilling, although it commonly is entirely ignored; with the common flange diameter of 1⅝ inch, this angle is very small, indeed, and seems hardly to demand a special spoke direction to meet it. Still, users and repairers of cycles are many of them well aware that the spokes taken out of an old cycle wheel often show a bend caused by incorrect spoke hole angle, and it may be of real importance that a rim drilling machine should make the nearest possible approach to geometric perfection in its drill spindle angles.

The Rudolphe & Krummel rim driller was approved by cycle shops other than the Sterling, and underwent a curious evolution under the stimulus of successive orders. The original Sterling machine, Fig. 84, was built December, 1892, for hollow steel rims, 24 to 32 inches diameter. The chuck had a vertical adjustment on the pillar. The chuck jaws were forced outward by 6 toggles, a slotted disc forming the common inner member for all the six jaw-actuating toggles, and the size adjustment being made by adjusting the outer toggle link studs in the slots in the revolvable center plate, all as quite clearly shown in Fig. 85, which is on a much larger scale than Fig. 84. The rim driller shown in Fig. 85 was very similar to the first, Fig. 84, the only material change being in the belt tighteners. The same general chuck construction was kept; the six chuck jaws have each two points of rim contact, making twelve points of rim support approximating fairly to uniformity of spacing. The rim holding chuck jaws were needlessly well supported in dovetail ways in the large cast iron back disc of the chuck, which was quite heavy, but gave satisfaction as nothing better was known at that time. The vertical chuck adjustment was retained, and the universal spindle angle adjustment, the prime feature of the first machine, has never been departed from.

No. 3, Fig. 86, was built in February, 1894, and shows how little a really capable designer believes in letting well enough alone. Cycle practice had brought the rim diameters to 28 and 26 inches almost exclusively, and this narrowing of diameter range rendered the vertical adjustment of the chuck needless, and it was omitted, the drill spindle and adjustment being sufficient. The chuck was cheapened and lightened, the diameter of the back plate being very greatly reduced, and the dovetail chuck jaw guide being abandoned in favor of a cylindrical jaw shank and sleeve guide for the jaw travel, but the chuck still required a vexatious adjustment for different rim diameters.

Rudolphe & Krummel, 1895, modified their chuck to a scroll, as shown in Fig. 87, which requires no adjustment for rims from 24 to 28 inches diameter. The pitch of this scroll is 1¾ inches, and the friction rolls on the inner ends of the sliding jaws are 1⅛ inches diameter, which makes the "land" of the scroll ⅝ inch face. The

scroll jaw action also makes a very light chuck, and in consequence of this lightness the chuck indexing action, which is had through a treadle, is very soft and durable in operation. The simple depression of the treadle by the foot first unlocks the chuck, then revolves it through either a single or double space as governed by a variable cam, and then locks the chuck rigidly in its new location; the return stroke of the treadle is wholly idle. Full working details of this scroll chuck and indexing action will be given later, and would have been given here had not Mr.

In regard to this rim driller the makers say, "This rim drill is the only one in the market on which rims can be drilled by going around once or going around twice, the rim being reversed in the latter case. In the first case the spindles are inclined, one forward and one backward, to the correct directions of two adjacent spoke holes toward the two flanges of the hub." (Non-tangential.) "This way has been adopted by most manufacturers using our machine, as preferable on account of the saving of time. In case alternate holes are drilled, both spindles point towards

thrown into cut by the action of a cam on either the dial or the chuck without the attention of the operator. As the machine stands now in the "Monarch" shop, there is a single spindle driller beside it, on which the air tube holes are drilled, thus necessitating a second handling of the rims which might easily be avoided.

The operator has both hands free and uses one hand for feeding each spindle down to its stop for the depth of countersink.

The capacity is easily 600 rims in ten hours.

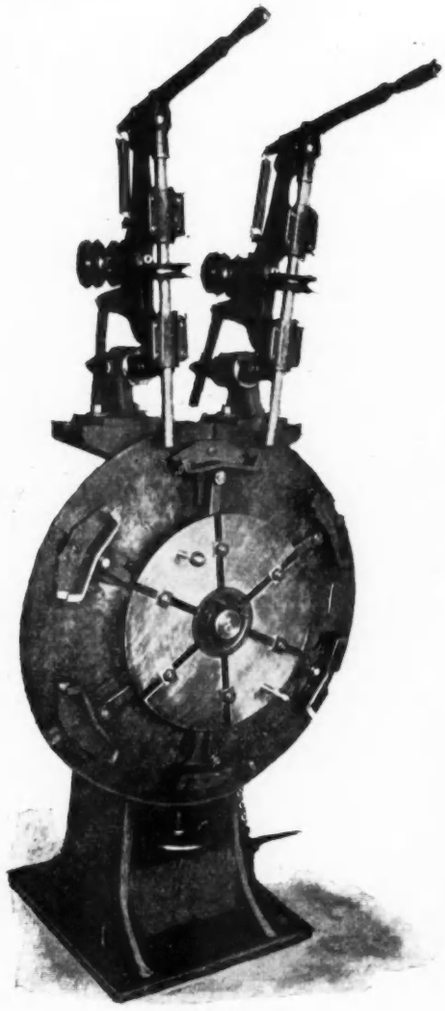


Fig. 85.

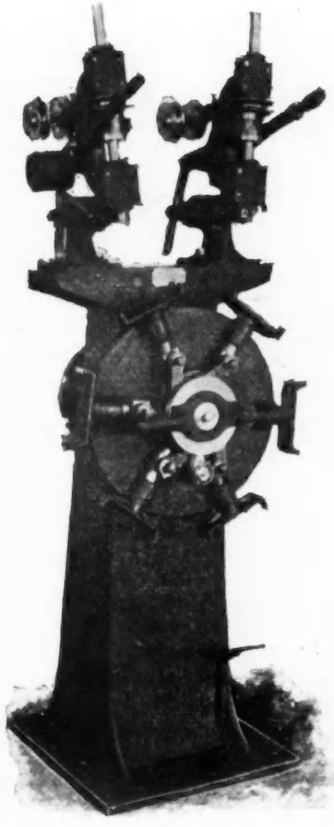


Fig. 86.

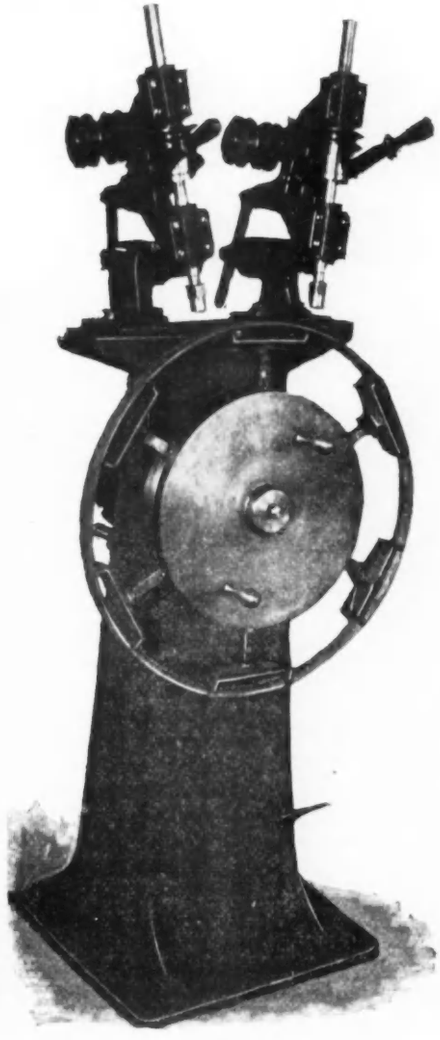


Fig. 87.

RIM DRILLING MACHINE.

Rudolphe been more fair of speech than prompt in action. This treadle indexing movement is the best application of the Forrestville clockmaker's index or "dial" action I have seen, and fills all the demands of the operation with such ease and certainty as to make it a model worthy of the designer's most careful attention. A really good treadle indexing action is in constantly recurring demand in small machine manufacturing, and thanks are due to Rudolphe & Krummel for their well considered details.

the same flange of the hub." (In this case the tangent angles can be given to the holes.) "The same dial plates can be used in both cases, a special spacing cam being furnished for the later case" (which causes the index to move two notches for each treadle movement).

The Rudolphe & Krummel driller would be greatly improved by the addition of an inflation tube hole drilling spindle, which might be easily arranged to operate automatically once only in each rim, the air hole spindle being

Rudolphe & Krummel build several other cycle tools, equally marked by originality and fitness of design, which will be fully noticed in their places.

A cycle shop department foreman writes that he is following these articles and says, "So far Hugh Dolnar has confined himself to trivial construction, and unless he branches out will not benefit readers who are anxious to know how bicycles are constructed; at the rate he is going on his articles will not be published for several years to come—that is, if he intends

to inform us how the complete bicycle is manufactured, and by that time he will be out of date, as the constant changes made both in bicycles and bicycle machinery keep a body constantly on the run to be up to the times. The ideas practiced by one factory are entirely ignored by others, and each thinks his own the best, and the changes each year keep one busy to follow the different modes of construction."

As men's thoughts vary little, it is quite likely that what this correspondent intends to say has been the thought of many readers of these "cycle tools" papers. In reply, I wish to say first that I cannot inform anyone "how bicycles are constructed." There is no machine in my knowledge which makes a bicycle, and only a very few machines which make all of even one single least part of a bicycle. I should like very much to have this correspondent define his idea of the meaning of "how a complete bicycle is manufactured," as he uses it above. I do not think he takes the wide view which would make an entire cycle factory, owners, patents, capital, superintendent, foremen, workmen, buildings and tools, all constitute one machine, for the "manufacture" of "the complete bicycle."

If this correspondent does mean this wide view of "how," which I do not believe, the information he desires could be given without many pictures. This machine for making a "complete bicycle" is, according to the "Monarch" and "Warwick" and "Victor" ideas, a shop equipped almost wholly with Pratt & Whitney and Brown & Sharpe tools, and operated on armory and sewing machine factory lines. In the "St. Nicholas" it would mean a shop full of home constructions; in the "Liberty" and "Waverly" it would mean medium price tools of regular makes, with as little home-made work as possible; at Pope's it would mean Pratt & Whitney and Brown & Sharpe tools, liberally mixed with home talent effects; in the "Western Wheel" it would mean put everything on the punching press, and run on German locksmithing lines, with regular beer at 9.30 A.M. daily, and so on without end. In some little shops it means buy all the parts at the lowest possible price, assemble them with cheap labor, put on a gaudy finish that will last until the low-priced wheel is sold, and change the name every season; in other small shops it means the very best of everything, all made at home by high-class workmen, and a small output of "on honor" work to be sold at fancy prices.

In any detail process this correspondent's implied machine for making "complete bicycles" may vary so much that the tools would not at first sight seem to be for the same purpose even. Take brazing for instance; brazing tools run all the way from mud ovens fired with soft coal, to hardly visible pencils of gas and air flame so perfectly burning that in the Pope brazing room hardly a flame can be seen, while at Ames & Frost's, as I saw it six months ago, the brazing room was a purgatory of smoke and flame, with streams of sweat running down the forms of the half naked workmen.

This correspondent will see, if he looks at the matter a little, that the phrase "how the complete bicycle is manufactured," which he uses, demands specific definition.

My own idea of "how the complete bicycle is manufactured" is that it is made up of parts; that each part is "manufactured" individually and by itself, and that all of these parts are finally assembled to form a "complete bicycle;" and that if I describe and contrast the most important methods and means of manufacture of these individual parts in, say, forty or fifty issues of the "Machinist," I shall do very well indeed; and I do not understand how a department foreman could use the expression "trivial details." There are no "trivial" things in manufacturing; the smallest detail must be made, and be made right and fit for its office, before the "complete bicycle" can be made, and no one should know this better than a department foreman, whose output and position depend wholly on his own ability and inclination to attend closely to small, not "trivial," details which make his work good or bad, and make him a valuable man in the shop.

The wheel with its adjuncts of axle and bearings and cranks, the chain and sprockets, and the frame, make up almost the entire bicycle; the wheel and its belongings form the principal elements of the machine, and will occupy at least two-thirds of the space given to the "bicycle tools" in the "Machinist."

Meantime, I shall be pleased to have this particular correspondent explain fully and in detail to me, personally, what he means by "how the complete bicycle is manufactured." I have lived too long to think there is any man who cannot tell me some things I do not know, and in regard to "bicycle tools," I very much wish information from each and every one who can give it to me. HUGH DOLNAR.

The "American Engineer and Railroad Journal" and the "National Car and Locomotive Builder" have been consolidated and will be published monthly under the name of the "American Engineer, Car Builder and Railroad Journal." M. W. Forney will be editor-in-chief.

A New Roller Bearing.

It will doubtless be remembered that in an editorial in our issue of October 17, 1895, we called attention to a well authenticated instance of an enormous saving of power by the substitution of roller bearings for bearings of the usual type in a machine for rolling sheet metal. We now illustrate the mode of arranging the rollers in the system employed in the instance mentioned. The cages employed for keeping the rollers in correct position and equidistant vary with the sizes of the journals and the peculiar service for which they are employed. The flange type of cage, Fig. 1, is most generally used. It consists of a tube or sleeve of parallel bars, the adjacent sides of which are concave, each pair together forming a channel in which one of the rollers may revolve. The bars are all connected at one end by a solid portion or ring of metal integral with the bars, and at the other end by the perforated flange, the outside of which is larger than the barrel portion. Another type of cage is called the built up cage, Fig. 2. In this also the bars are connected by the metal at one end, and closed at the other end by a cap with projections fitting into the spaces between the bars, and there held in place by a spring wire in a groove common to both the bars and the projections. In bearings where heavy loads are to be carried, as on roll journals for rolling metals, it is necessary to have the journals hard and ground to exact size, and the boxes in which the rollers revolve fitted with steel shells hardened and ground, to secure the best efficiency. Chilled iron journals have also been tried and are running with satisfaction. When this bearing was first tried on the rolls of a small rolling mill a great saving of power was at once exhibited.

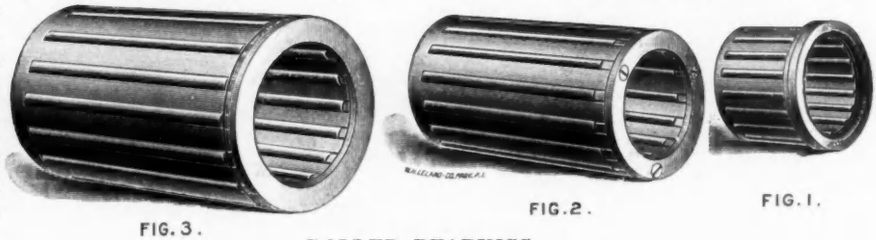


FIG. 3. FIG. 2. FIG. 1.

ROLLER BEARINGS.

A gain was also made in another direction. It has been the practice heretofore to make the roll journals as small as possible, to gain leverage in journals and boxes, but this caused heating on account of the excessive pressure. With this roller bearing it is permissible to make the journals as large as may be desired, thus making the rolls stiffer. It is found also that the speed of the rolls may be doubled if required without any inconvenience.

As we previously stated, when this roller bearing was applied to a mill by the Brown & Sharpe Mfg. Co., it was found that with a two-inch driving belt more strain could be put on the stock to be

rolled than had previously been possible with a six-inch belt and a four-inch belt running on top of it. Another manufacfacturer who had been using an eight inch belt with the old bearings ran the same mills constantly with a two-inch belt after the roller bearings were substituted. The Brown & Sharpe Mfg. Co. since their first experience with these roller bearings have used them upon a number of special machines. Electric cars have been equipped with them with most satisfactory results, especially as to wearing qualities. They would seem to be especially desirable for the horseless carriage, as the bearings are capable of carrying a greater load, and at the same time require less accurate fitting than the ball bearing. Fig. 4 shows a roller bearing hanger for line shafting, the desirability of which need not be expatiated upon to readers of the "American Machinist." A new and cheaper method of manufacturing the roller cages has recently been perfected which will reduce the cost and bring the bearing within the reach of all who may wish to employ it. The bearing illustrated is made by the Mossburg Manufacturing Company, of Attleboro, Mass., who use it upon the full line of rolling mills for sheet metal manufactured by them. These mills were illustrated in our issue of April 11, 1895.

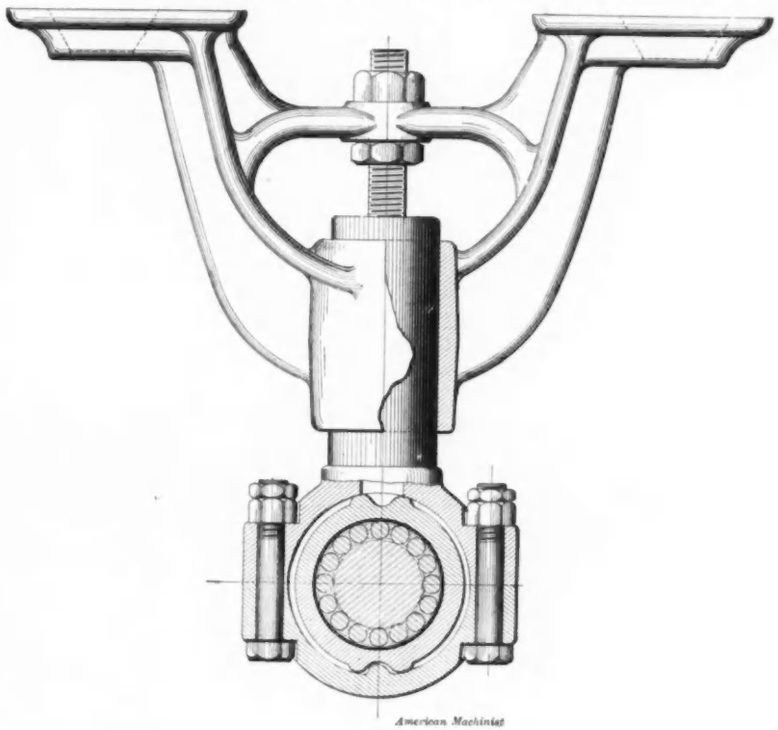


Fig. 4.

Working Steel Like Dough.

Among the most important of recent German inventions in the field of mechanics is unquestionably the Erhardt process and apparatus for manufacturing tubular boilers, which has been patented in Europe and America, and has been, during the past two years, in highly successful operation at the works of the Rhenisch Metal Ware and Machine Company, at Dusseldorf.

The principle underlying this process appears not to be entirely new, a somewhat analogous method having been already employed on a limited scale in England, but the machinery and working methods devised by the German inventor are so far in advance of all precedents that his patents, even in the United States, are claimed to be fundamental and comprehensive.

The process in question is for making tubes of all kinds, gun barrels, hollow projectiles, acid flasks, parts of machinery which combine the utmost degree of lightness with adequate strength, in fact, an indefinite variety of hollow metallic articles by thrusting a steel core or mandrel through a billet of hot steel, wrought iron or other metal, which is held firmly in a matrix of such shape and caliber as to give the required outward form to the completed object.

In the works at Dusseldorf, the mandrels are operated by hydraulic pressure, and are usually set in a horizontal position, though this is immaterial, the matrices being held in position in massive iron bed frames and carefully adjusted so that the mandrel, being steadied at the point of impact by firmly fixed guides, shall pierce the exact center of the billet, and, by compressing the yielding metal outwardly into the space between the mandrel and the matrix produce a hollow body, the shell of which is everywhere of exact and uniform thickness. Both mandrel and matrix, or either of them, may be round, square, hexagonal or of any other desired sectional shape, so that round, square, or otherwise formed tubes may be made with equal facility. Not only wrought iron and steel, but copper and other malleable metals are worked with entire success by this process, the only requirement being that the blank billet, in case of each different metal, shall be worked at such temperature as to secure its highest degree of malleability and ductility.

The advantages claimed and apparently already realized by this process are, first, an economy which, in case of several leading articles, is not less than 50 per cent. over any other method that has been hitherto employed, and, secondly, a definite superiority of quality in the finished article.

This superiority results naturally from the conditions under which the plastic metal is molded by mechanical pressure into the required form.

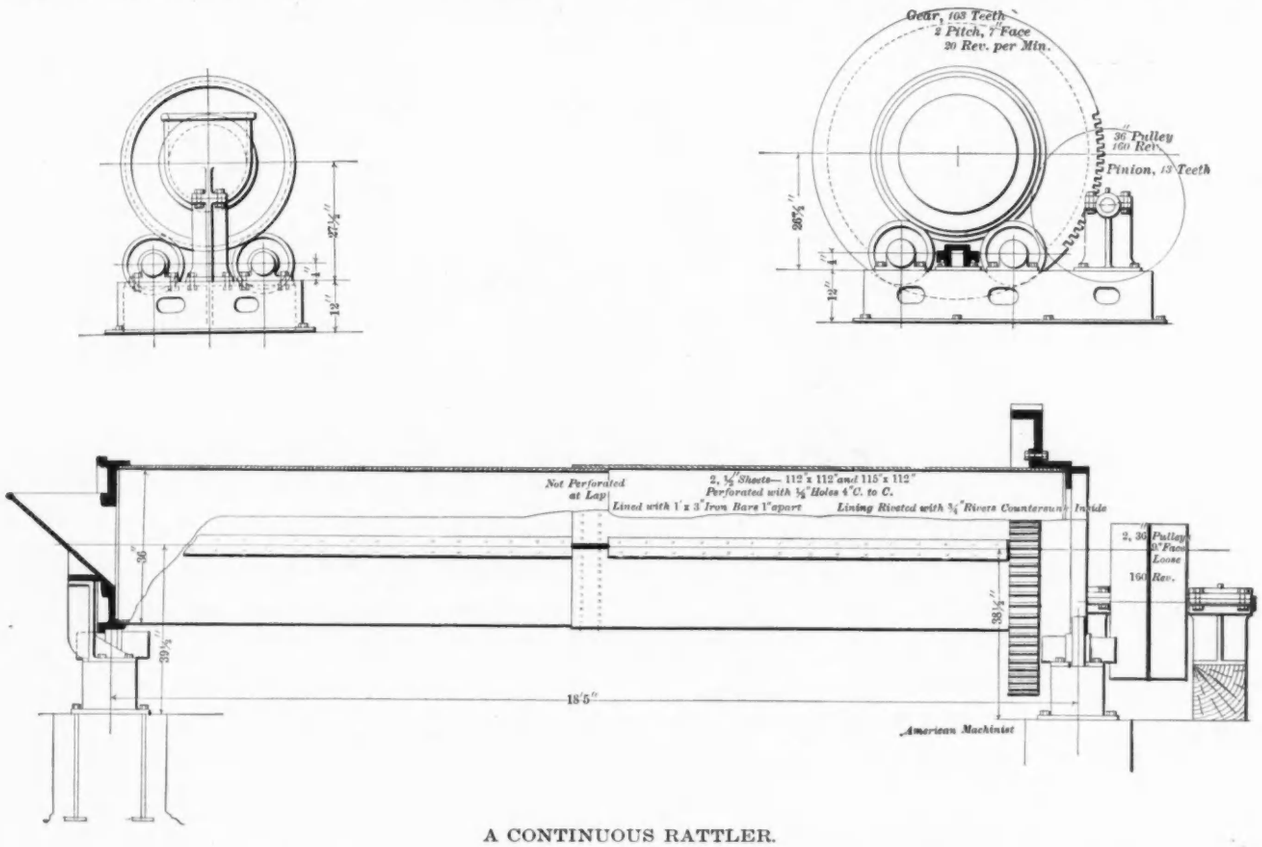
When, for instance, a gun is made, by the old method of forging a solid blank, which is then hollowed out by boring, it may often happen that the firmest and most homogeneous part of the steel at the core of the billet is cut away by the drill, which reveals nothing of the flaws and imperfections that may exist in the interior surface of the barrel. Similar defects may occur in boiler and other tubes made by welding or other processes ordinarily employed; but by the Erhardt process, the solid cube of metal is pierced, forced through the matrix, elongated and driven by lateral displacement into its new form by a steady, resistless power, which compresses the metal to a high degree, welds and obliterates every flaw or seam, and leaves as the hardest, densest portion of the tube or barrel the interior surface, which it leaves with a glistening appearance, as though polished by friction or hammering.

Among the varied purposes to which the process has been applied at Dusseldorf, the two simplest and most susceptible of ready description are the manufacture of shrapnel shells for the German field artillery and steel flasks for containing liquid carbonic and other acids. The problem, in the first instance, is to make by the best and cheapest method a hollow, pointed steel projectile, about 3 inches in diameter by 12 inches in length, the shell of which is about one-fourth of an inch in thickness and of exactly uniform weight on all sides, so as to secure to the projectile a perfect axial rotation when in flight. For this purpose a 3-inch cube of mild steel, heated to a cherry red, is dropped into a slot at the opening of the matrix. A touch upon the lever controlling the hydraulic press starts the mandrel, which, with one noiseless thrust, pierces the billet, drives it through the matrix, draws it out like wax, spreading the pliant metal over the end of the mandrel like the finger of a glove, shoves the end of it into a die which tapers

it to a point, and within two seconds of time the process is complete.

Similarly, from larger steel billets, acid flasks 4 or 5 feet long by 8 inches in caliber are made and shaped by a single movement of the press, without a seam or flaw, and of such quality that its thin shell sustains an expansive pressure of 250 atmospheres. So superior, indeed, is the work turned out by this method, that the German Government has required the principal maker of guns and projectiles in that country to adopt the Erhardt process for the manufacture of such war material as is delivered for the use of its army and navy. The same system works equally well in the manufacture of hollow projectiles of all larger sizes and in making steel cannon tubes of 3-inch, 6-inch and greater calibers. In all these specialties, the quality of the product is pronounced by ordnance officers not only superior to that of shells and guns made by other methods, but the saving in cost is said to be fully 50 per cent. Copper tubes of all ordinary sizes, and of any length up to 20 feet, are likewise made by the Erhardt process, the limitations of which, in respect to diameter, length and shell thickness of the hollow body produced, are fixed only by the size of the machinery and the degree of dynamic force employed.

But the ultimate value of the invention will be measured by its application to mechanical construction in substituting hollow, and, therefore, lighter parts of machinery and structural forms for those which are now made of solid metal. The progress of modern mechanics is toward the utmost economy of power through the saving of friction, directness and simplicity of coupling, and lightness of construction of all working parts. Axles, shafting, pinions, driving rods, and other parts of machinery that are now solid and inert, will, in future, be made hollow, and from metals and alloys of highest resistance. In all this wide and important field of improvement, the process herein described seems likely to play so important a part that its successful introduction, already an accomplished fact, is believed by competent engineers to mark an epoch in the progress of metal working.


Gear, 103 Teeth
2 Pitch, 7" Face
20 Rev. per Min.
36" Pulley
160 Rev.
Pinion, 13 Teeth
Not Perforated at Lap
2, 1/8" Sheets— 112" x 112" and 115" x 112"
Perforated with 1/2" Holes 4" C. to C.
Lined with 1" x 3" Iron Bars 1" apart
Lining Riveted with 3/4" Rivets Countersunk Inside
2, 36" Pulley 6" Face Loose
160 Rev.
18'5"
American Machinist

A CONTINUOUS RATTLER.

A Continuous Rattler.

At the Schenectady Locomotive Works all forge scrap is put through a rattler. This, by cleaning off the oxide and dirt, and leaving the iron bright and clean, is found to effect a marked improvement in the quality of the forgings. Of particular interest is the construction of rattler used, of which, by the courtesy of the Schenectady Locomotive Works, we publish herewith an engraving made from the construction drawing.

The machine consists of a long cylinder of boiler iron, perforated and shod upon the inside with iron bars. The cylinder is carried upon rollers and driven by gearing, as clearly shown. A hopper is mounted upon a stationary bracket at the left hand end, and projecting through the cylinder head, serves to conveniently introduce the scrap to be rattled. This end being at a slightly higher level than the other, the scrap naturally travels toward the right hand end, from which it is delivered continuously. A retaining flange will be observed upon the inside of the right hand end casting. A delivery spout, of the same diameter as the opening through this flange, is riveted to the flange by means of an angle iron ring, and serves to deliver the rattled scrap beyond the driving gearing. A roller for taking the end thrust of the barrel will be seen in the right hand end view.

The rattler is considered a great success, and its application to foundry work is contemplated.

What seemed likely at one time to be a somewhat troublesome case has been settled by a joint resolution of Congress authorizing the Secretary of the Navy to accept the ram "Katahdin" and to make it a part of the navy. Investigation had previously shown that while this vessel did not meet the full and exact requirements of the contract in regard to speed, yet the contractors, the Bath Iron Works, were really in no way to blame for this, and the vessel is in point of fact a decided credit to them. The executive officers of the government, however, could not, of course, go behind the exact terms of the contract in regard to its acceptance without authority from Congress.

A New Tool Grinding Machine.

In our issue of August 13, 1887, we gave a description, with illustrations, of a "universal tool grinding and shaping machine," then recently perfected at the works of Wm. Sellers & Co., Philadelphia.

We stated that the machine would grind all the faces of lathe, planer, slotter, shaper, and almost all other forms of tools; in fact we said, "We have yet to see the kind of tool that this machine will not grind. We have seen tools brought direct from the blacksmith shop, placed in this machine, ground and shaped in a comparatively short time to an exactness which, to obtain, would require the best effort and test the skill of an expert tool maker equipped only with an ordinary grindstone."

Experience has proved that this machine not only accomplished all that was then predicted, but much more; it has, in fact, revolutionized the entire system of grinding, shaping and handling cutting tools in many large establishments.

To speak more precisely, we may say that the machine has created an exact system where none formerly existed; instead of each lathe or planer hand, for example, being expected or permitted to grind his own tools to suit his own fancy, all the tools in shops equipped with these machines are accurately ground thereon by one man to predetermined shapes which experience has proved are best suited to the special work they are to perform; and while it is not pretended that the machine will grind all tools to better shapes than the most skillful men will grind them with ordinary appliances, it will grind all tools better than many men will grind them, and some tools better than the most skilled men can grind them; so that the general results have been found very favorable to the machine, both in point of economy and in relieving machinists of a somewhat disagreeable task.

The introduction of this new system which accompanied the machine marked an important advance in modern machine shop practice which has been frequently commented upon.

The original machine was designed not only for all ordinary sizes of cutting tools, but to take in very large tools, with shanks 2 inches square, and to grind, not merely ordinary shapes, but also special tools of any peculiar form. The introduction of this machine was, therefore, confined mainly to the largest shops, but experience has shown that there is a wider demand for an equally accurate machine adapted to the requirements and means of smaller shops. Such a machine has now been perfected by the Sellers Company, and, although constructed upon somewhat different lines, whereby it has been greatly simplified and the cost of construction correspondingly decreased, efficiency and accuracy have not been sacrificed.

We present herewith an illustration of this "No. 2" universal tool grinding machine.

The chuck of this machine will grasp tools with shanks up to 2x1½ inches and 14 inches long, and is strongly designed so that its range is ample for all ordinary work.

It is provided with "formers" (shown in the picture upon the floor), for shaping curved faced right or left hand tools, straight or bent, or straight and circular tools, together with a gauge for setting curved faced tools in the holders.

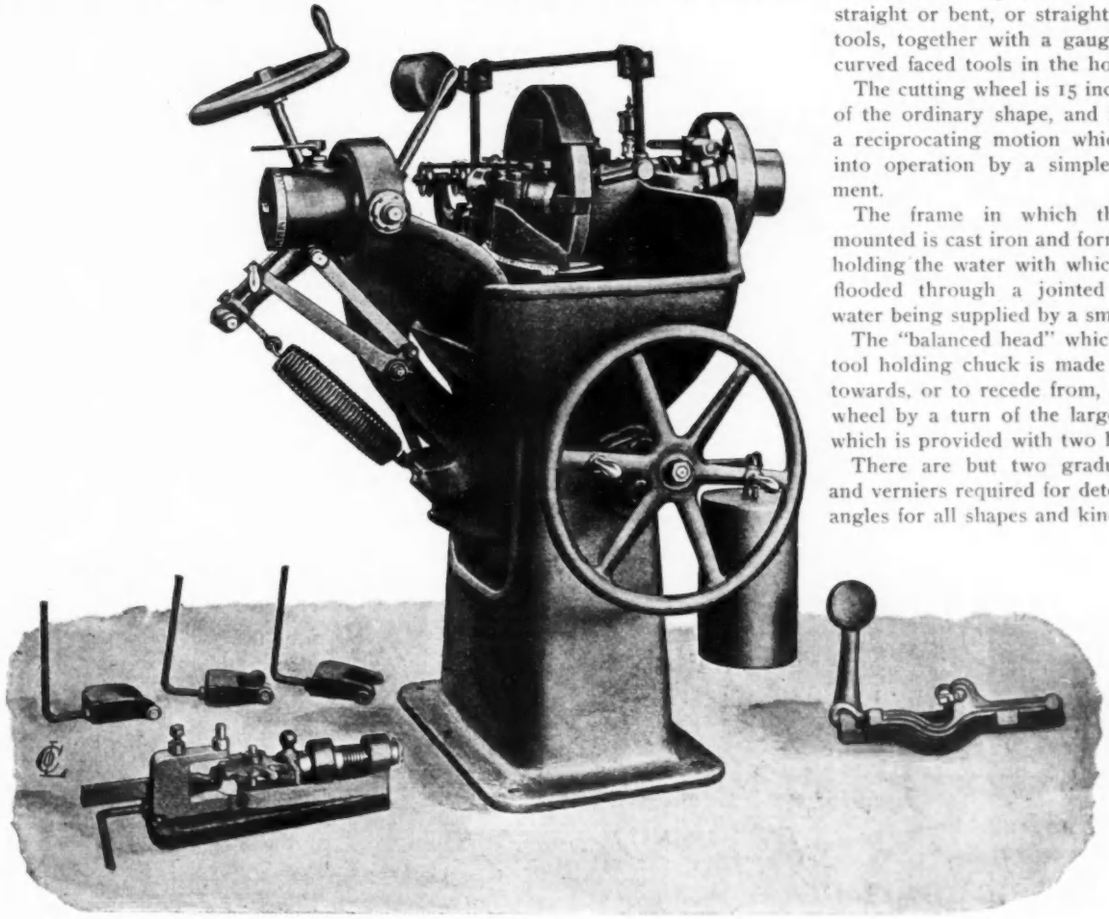
The cutting wheel is 15 inches diameter of the ordinary shape, and is capable of a reciprocating motion which is thrown into operation by a simple cam movement.

The frame in which the wheel is mounted is cast iron and forms a tank for holding the water with which the tool is flooded through a jointed nozzle, the water being supplied by a small pump.

The "balanced head" which carries the tool holding chuck is made to approach towards, or to recede from, the grinding wheel by a turn of the large feed wheel which is provided with two handles.

There are but two graduated circles and verniers required for determining the angles for all shapes and kinds of cutting tools; one of these may be seen on the balanced head, the other on the chuck.

The operation of setting the tool for any desired shape and angle of clearance is performed in a moment, and the contact between the wheel and tool is a line and not a surface, which is considered to be an essential condition for efficient work. The wheel, though coarse in texture, grinds fine, with great rapidity and without burning the tool, as it would be likely to do if a considerable surface were applied to the wheel, and the water therefore excluded from the interior portions of the surface.



UNIVERSAL TOOL GRINDER.

A large card diagram is provided giving the cutting and clearance angles of all tools, as determined by the Sellers system, these figures can be readily modified to suit any preference. The mechanism is so simple that the operator very soon becomes familiar with the readings for all regular types of tools so that he rarely requires to refer to the card.

The "former frame" fits into the regular chuck, and it requires but a moment to make the necessary changes to shape and grind new tools of different patterns. Twenty-five rough forgings may be readily shaped and ground into finished tools in one hour by a fairly drilled operator; all tools ground upon the machine fit the standard gauges accurately.

There are a number of interesting minor features showing that all the details have been carefully studied in the light of past experience; the bearings, for example, are thoroughly protected from particles of grit; the tank has a low partition beneath the wheel which serves as a "catch all" to intercept any mechanically suspended particles of emery or other material, the overflow water is pumped back again and again; finally, when the water becomes stale it may be drawn off and the tank washed and refilled.

The fast and loose pulleys are 10 inches diameter, 5 inches face and make 360 revolutions per minute.

The Kane-Pennington Motor—II.

BY JOHN RANDOL.

Here follows all that is at present known by any one concerning the Pennington gas engine. Everything here stated and shown can be relied upon; the indicator cards were taken in my presence, the blue prints are those from which the work was built, and the other engravings are from my own photographs.

The simplicity and lightness of the engine, and its high-speed possibilities, make it evident that Pennington has, with his simple mechanical elements, apparently secured all of the advantages which can be obtained from any explosive or "impulse" motor in the sizes with which these tests were made. In other words, until some other man cheapens and lightens Pennington's work, it must stand as the cheapest, lightest and most efficient motor so far produced, of its dimensions, and as marking a new era in the possibilities of locomotion.

The Pennington motor can and does run continuously without a water jacket, although the work here shown is all water jacketed. The bicycle and tandem shown in the "American Machinist" of November 7, 1895, have naked cylinders, and give no trouble whatever from overheating. In the course of several days of close observation of the workings of the cycle and tandem, much of the time at very high speeds, I saw no case of cylinder heating to such an extent as to interfere in any way with lubrication. I saw the cycle suspended by ropes and run for hours together, reaching I believe as much as 1,500 revolutions per minute at times, and perhaps even more than that, with no change in the heat of the cylinders, as evidenced by the discoloration of the metal; the blued area of the cylinder extension forming the explosion chamber did not increase in either direction; a bright line made with emery cloth across this blued section while the engine was cold has its color re-established with the first few revolutions of the engine, and this area of color remained constant; a light blue over the center of explosion, with a boundary at either end of the temper colors. Part of the heat, of course, vaporizes the fluid, part of it goes into work, and part of it is dissipated by radiation from the outer surface of the cylinder, but most of the heat, probably, is taken from the inside surface of the cylinder by the cylinderful of cold air drawn in and pushed out for each exposion.

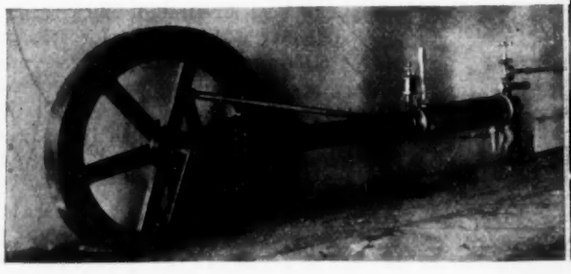


Fig. 1.

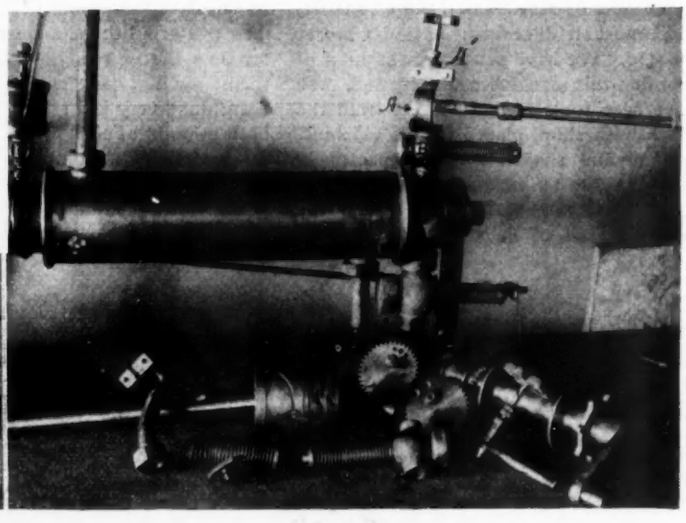


Fig. 2.

PENNINGTON ENGINE.

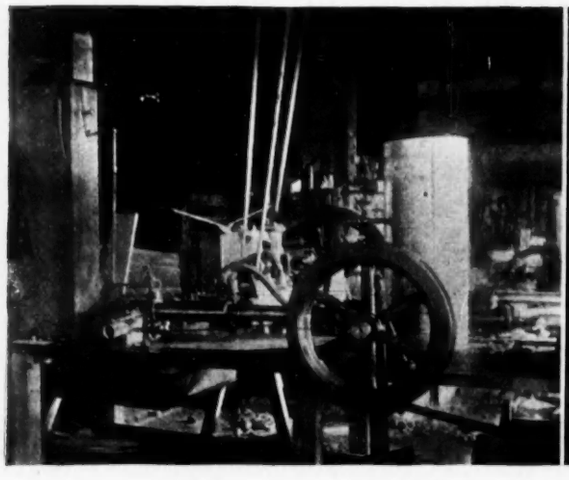


Fig. 3.

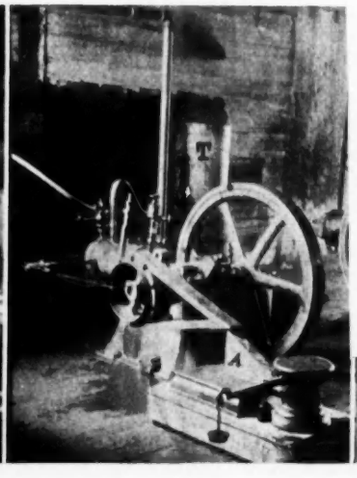


Fig. 4.

Fig. 5.

PENNINGTON ENGINE TESTING.

There is no mystery about the Pennington motor. It is simply a wonderfully independent breaking away from all precedent. Pennington wished the most powerful motor for a given weight; he took steel tubing for his material, discarded all but the naked essentials of cylinder, piston, connecting rod and crank shaft, and, with no scientific theory whatever, proceeded to create his motor. The result is shown in what follows:

The 2½x12-inch Pennington engine is shown in Fig. 1, a front view; Fig. 2, an enlarged view of the water jacketed cylinder of this engine and its accessories, with sundry detail parts of similar motors grouped in the foreground, and Fig. 3 is a complete rear view of the engine, its water tank and its kerosene tank, with valve is supported on a C-shaped bracket, and the point of the needle-valve stands free in the air above the admission valve B, which supports the bracket A, so that the admitted stream of fluid is visible to the eye; it was so small in quantity as to fall in drops, closely consecutive, but not a stream. No attempt was made to measure the quantity admitted per stroke, nor to ascertain the actual work done. There was nothing at hand with which to do more than obtain a fairly representative indicator card, and circumstances which need not be detailed here made more complete tests impossible. Four cards are given. Nos. 1 and 2 were made with a leak in the coupling; No 3, and several more like it, which I have given away to interested persons, were taken after the coupall experts who have seen it, and all to whom I have personally described it, and I therefore reproduce everything of possible value in my possession.

These cards, 1 and 2, show a compression of 60 or 61 pounds, and an explosion pressure of 143 or 144 pounds in card No. 1, and 156 or 157 pounds in card No. 2. These were made with a leaking coupling.

It will be noticed that this coupling leak between the cylinder and indicator decreased the height of the explosion line much more than it decreased the height of the compression line, and so gives an entirely incorrect idea of the relative compression and explosion areas in cards 1 and 2.

Cards 3 and 4 show a compression of about 65 pounds, and an explosion pres-

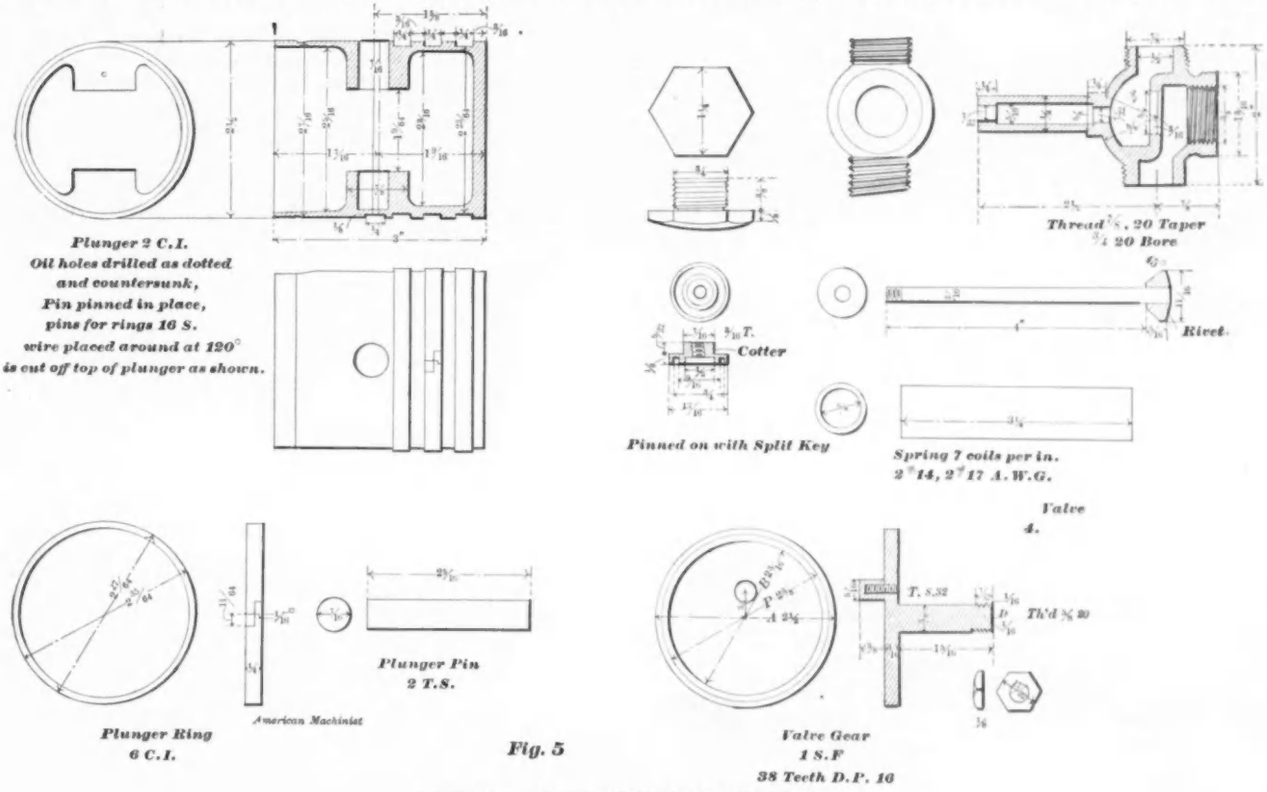


Fig. 5

DETAILS OF PENNINGTON ENGINE.

the indicator in place all as it stood when the indicator cards here given were taken for me by Mr. Milton Beck, November 20 and 22, 1895. The cards taken from the 2½x12-inch engine here shown were made by Mr. Beck November 20th, with his own Hine & Robertson indicator, 125 pound spring. The number of revolutions was not taken, and the brake used was a board with one end resting on the floor and the other end held up by hand, so as to keep the engine at about a uniform speed of perhaps 300 or 350 revolutions, more or less, the load being such as to work the motor to about its full capacity. This test, of course, determines nothing except what is shown by the card. The fluid (kerosene oil in this case) was admitted to the cylinder by a needle-valve, clearly shown at A, Fig. 2. This needleling was made tight. Nos. 2 and 3 are made from my own pen, tracing over the indicator pencil lines. No. 2, which was made while the hand-held board brake, was kept at a tolerably uniform pressure, has a very distinct pencil line made by a considerable number of strokes of the engine, and is the engraver's reproduction of the indicator card, otherwise untouched. No 4 is also the engraver's tracing of the original untouched indicator card, which also shows a heavy and firmly traced line made by many revolutions of the engine. All of the indicator cards given are fair full size reproductions. This variety of cards is given to place all available information before the reader. Card No. 4 is better than any of the others, and in the common course of things would be given alone; the Pennington engine has greatly interested sure of about 170 pounds. They show that the charge was fired at the end of the stroke, and by the first spark, and that the deflagration was nearly instantaneous and nearly perfect. The slight swell in the line after the first drop often appears in good gas engine cards, and cannot possibly be attributed to any action of the second spark. It is indeed an almost absolute impossibility that an explosive gas confined in a closed chamber should not be all exploded when that chamber was filled with flame, which is the case when any explosion takes place, and the card shows plainly and certainly that the explosion of the charge did take place at the inward extreme of the piston travel, as it should do.

Cards 3 and 4 are made with the lightest and simplest machine which has been, so

far as I know, ever shown, and with a machine which is very far from accurate in finish of parts. The machine work on the Pennington motors which I have seen is not of a high grade; it cannot possibly rank beyond fair ordinary machine shop practice in any particular; there is nothing modern and nothing "special" in the way of tools in the shops where these motors were built; the performance of the motor is due solely to design, not at all to workmanship.

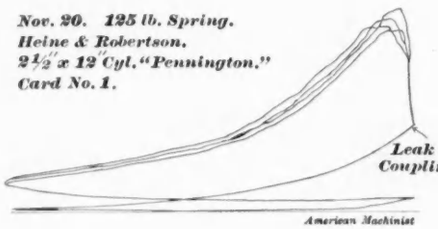
Cards Nos. 5, 6 and 7 were made from a "Regan" gas engine, using gasolene without a carburetter, the fluid being admitted directly to the cylinder, and the cylinder being water jacketed the whole length, over the explosion chamber as well as over the piston travel. This engine and the apparatus used in making the test are shown in Fig. 4. The block A, on the scale platform, weighed two pounds, which two pounds is to be deducted from the brake load as given with the cards, if any one cares to run through the h. p. figures. The whole test was so rude and made under such unfavorable circumstances that nothing but the cards can be regarded as of any value. The fluid used was gasolene, not kerosene oil, which last was the fluid used in the Pennington 2½x12-inch motor.

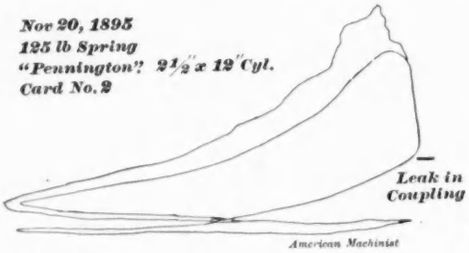
The Regan engine is not intended to take a hydro-carbon directly into its cylinder, and the one shown in Fig. 4 had been arranged for experimental use in a very rude manner; so rude, indeed, that the efficiency of the engine was largely increased by laying a small piece of wood on top of the open-mouthed oil cup through which the fluid and air constituting the explosive charge were admitted to the cylinder, the wood block reducing the quantity of air admitted at each charge. The brake was not water cooled, and could be run only two or three minutes before heating so much that it had to be slacked off. The revolutions were counted from the hand on the exhaust lever and the eye on a watch dial. The shed in which the tests were made was cold and wet and dark, and only as before stated the cards have any value.

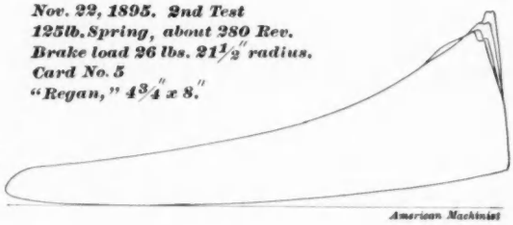
Card 5 was taken from this modified "Regan" engine, with a Pennington "double spark" igniter. The cylinder dimensions were 4¾ inches diameter by 8-inch stroke. Revolutions about 280. The brake itself was extremely poor, difficult to adjust, and not holding its adjustment with any degree of uniformity. The needle valve fluid admission was difficult to regulate, being fitted with a vexatious check nut on the valve stem, and the engine was often flooded with gasolene. Under these circumstances of production, card No. 5, made with the Pennington igniter, is very good. The engraving is full size, and is the engraver's reproduction of the pencil, and can be measured by the curious.

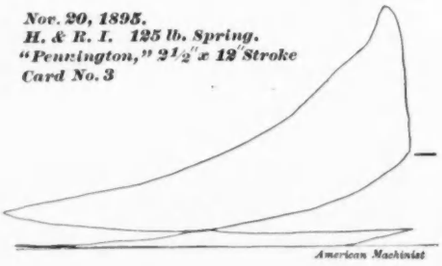
Cards 6 and 7 are from the same, everything as with 5, except that in place of the Pennington double spark igniter, a single spark was given at about 7-10 of the piston travel of the working stroke, as I was told by Mr. Carse, who has made the most of the experiments on the "Regan" engine. The card shows a much later ignition, and a very slow deflagration, so slow as to suggest combustion rather than explosion. This was the test which I was assured would convince me that the "double spark" fully doubled the power of a good common gas engine. The Regan engine cylinder and combustion chamber are wholly water jacketed, and the Regan engine is not designed to take fluid directly into the cylinder, and there convert the hydro-carbon into an explosive gas mixture; it is designed to use a carburetter and to draw a mixture of gas and air into the cylinder. The cylinder is evidently not hot enough to vaporize the charge with certainty when fluid is admitted directly to the cylinder, and hence the late spark is the worst of all possible errors; in all cases the igniting spark should be delivered just before the end of the charge compressing piston stroke; then if any ignitable vapor is in reach of the spark the explosion chamber is at once filled with flame, and a more or less quick deflagration of the charge is effected in the long time dwell of the piston near the crank center. With the late spark the explosion, as shown by the cards 6 and 7, was often not completed at mid-stroke of the piston, and in some cases the highest pressure is as late as the beginning of the last third of the piston travel in its working stroke; the power of the engine becomes very small indeed under these conditions, and cards 6 and 7 show as bad a state of affairs as could exist in an explosive engine which could run at all.

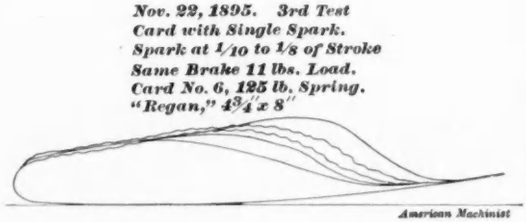
It must be understood that these cards are not "Regan" gas engine cards. Many hundreds of the "Regan" gas engines are in use equipped with the carburetter; in these motors the late spark finds a perfectly mixed and wholly carburetted compound which it can ignite so promptly as to give a vastly different card to Nos. 6 and 7 here shown. I do not know what the normal "Regan" card is, as I have

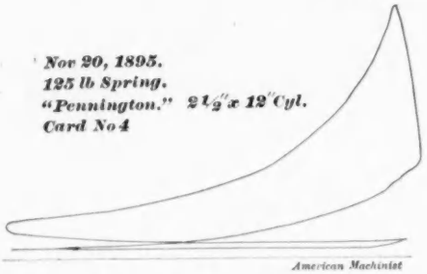


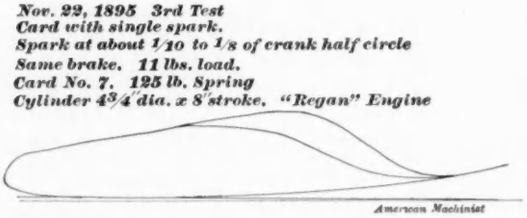







Nov. 22, 1895. 3rd Test
Card with Single Spark.
Spark at 1/10 to 1/8 of Stroke
Same Brake 11 lbs. Load.
Card No. 6, 125 lb. Spring.
"Regan," 4¾" x 8"
American Machinist




Nov. 22, 1895 3rd Test
Card with single spark.
Spark at about 1/10 to 1/8 of crank half circle
Same brake. 11 lbs. load.
Card No. 7. 125 lb. Spring
Cylinder 4¾" dia. x 8" stroke. "Regan" Engine
American Machinist

never seen it, but it certainly does not resemble the last two cards ; if it did, the "Regan" would not find buyers for any purpose whatever.

Pennington's details are of a high order of construction merit. His admission and exhaust valves are identical, though one is automatic and the other is mechanically actuated. This valve is fully shown in detail in the blue print reproduction, Fig. 5, and in the engraving Fig. 6, from photograph of parts. As an admission valve through which the mixed hydro carbon and air charge is drawn into the cylinder at B, Fig. 2, there is a cylinder pressure to keep the valve closed during the compression, working, and cylinder clearing strokes of the piston; during the charging stroke of the piston the external atmospheric pressure holds the valve open. The valve stem is made 1-32-inch free in its guides, consequently part of the exhaust and part of the admission pass between the valve stem and its guides, and keep both clean and free, as they must be for the speeds which the Pennington engines can attain. The piston details demand little explanation.

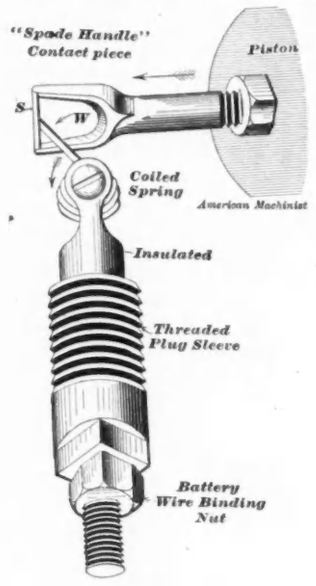


Fig. 7.

Pennington Ignition Parts.

In Fig. 6, S is a ring-grooved valve-spring washer, which had a screw slipped into the valve stem hole to support the washer while the photograph was taken. This screw does not belong to the washer.

The Pennington igniter is shown in the hand sketch, Fig. 7, as none of the shop drawings could be made to give a clear idea of its action. The coiled spring carries the current, and the free straight contact end, W, of this spring stands normally nearly vertical. Consequently, the contact between S and W takes place considerably earlier in the piston stroke than the almost final position shown in Fig. 7, and since there is a sliding contact from the instant S first meets W, there is a close succession of small sparks from that first contact until the last of the piston travel carries S so far to the left of W as to release W, and thus cause the delivery of the charge firing spark. The piston stroke to the right quickly brings S and W into a second contact with the same result of a chain of small sparks, which is what Mr. Pennington described as "the long, thin spark," followed at the instant of release by a spark of much greater volume or intensity.

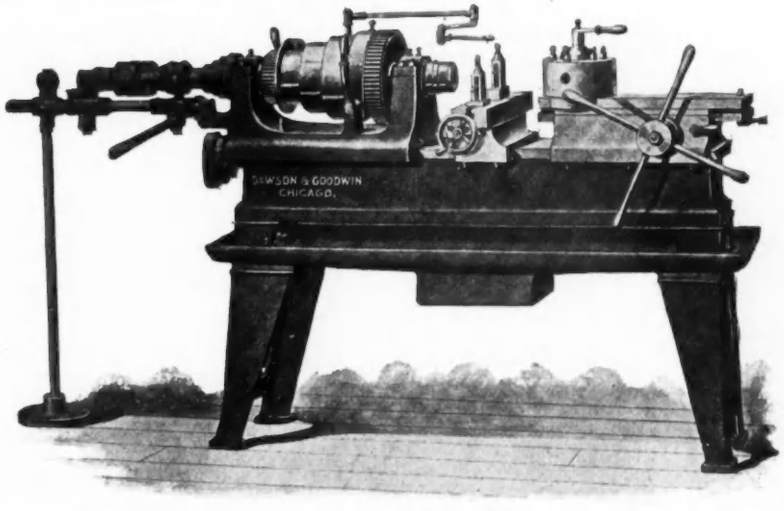
The chain of small sparks delivered during the latter part of the compression stroke does not explode the charge; what effect, if any, these small sparks have on the charge, I do not know. There is evidence which has been held to indicate a greater effect and a cooler cylinder, when this form of igniter which gives this chain of small sparks is used, than when only the single final charge firing spark is delivered.

W, Fig. 7, is made of such length as to be released from contact with S as late as possible in the compressing stroke of the piston.

Pennington has tried many igniters, and prefers the form shown because of small first cost, certainty of operation at high speeds, and durability, which is so great as to give no signs of injury in any test so far made.

Screw Machine.

We give herewith an illustration of a screw machine, the general construction and design of which will be readily understood from the engraving, by which it will be seen to conform in the main to regular practice.



SCREW MACHINE.

The bed is of the box pattern and dovetailed for the reception of head and other parts.

The head stock rests on an adjustable taper gib, the full width and length of same, and is also provided with a lateral adjustment for keeping it in perfect alignment with the turret slide; this arrangement being thought preferable to an adjustment of the turret slide itself.

The friction clutch back gear is of a new design, very simple in operation and positive in action. The wear is taken up by a screw driver from the outside, without removing the cover.

The spindle is of hammered crucible steel. The bearings are ground and run in phosphor bronze boxes, with special means for oiling and taking up the wear.

The wire feed apparatus is of the well known Parkhurst type and needs no detailed description. It feeds the stock forward and grips it while the machine is running.

The turret revolves automatically on a ground steel stem with special devices for taking up the wear.

The index ring is of hardened steel, with ground notches for the locking key. This key, which is also hardened, works between two taper gibs for taking up the wear and to keep the alignment in the turret.

The turret slide moves in square bearings with a taper gib for wear.

The power feed has three changes of feed, proportioned so as to allow two for turning and one for drilling. The tripping is performed by the stop screw, and is positive in action. It is operated by the small handle shown in front of the turret.

The cut-off rest is extra heavy, the square collars under the taper adjusting wedges giving extra solidity to the tools. The clamping of the turret and cut-off rest to the bed is done by the square screw heads shown in front, and with the new gib arrangement it is quicker and more effective than found in any other machine of this class.

An oil pump with relief check valve furnishes a stream of lubricant to the cutting tools.

The machine is made in two sizes by Dawson & Goodwin, 57 South Canal St., Chicago. Ill.

ELECTRICAL MACHINERY.

Electrotechnics—II.

The Principles of Electricity for Practical Men.

BY FRANK S. MASON.

6. OF THE REAL NATURE of the electric current, or whether there be in reality any such thing, we are ignorant. It is a fact, however, that the laws governing what we call a flow of electricity through a conductor are similar to those governing a flow of water through a pipe, and the units used to express in figures the properties of a current of electricity are strictly comparable to those used to express the strength of a current of water.

There are but two factors required to express in figures the flow of a current of water through a pipe or channel, viz., the quantity and the time. Just so, two corresponding factors express the flow of an electric current. But here is a confusing point: The hydraulic engineer talks of gallons per minute, while the electrical engineer talks of amperes, which are coulombs (a certain quantity of electricity) per second. It is as if a gallon per minute were called a blake.*

It is evident that the volume of flow of either a current of water or a current of electricity will depend upon the motive force by which it is impelled. The unit of electro-motive force, as has been noted (section 5), is termed the volt, which may be compared to one pound pressure per square inch.

The analogy holds still further. The volume of flow of water through a pipe depends upon the pressure, but it also depends upon the friction of the water in the pipe. This friction depends upon the size of the pipe and to a lesser degree upon its material and surface as regards smoothness, etc. It also depends upon the velocity of water in the pipe, the friction being more at high than at low velocities; just so the volume of the flow of electricity depends upon the electro-motive force (pressure), and upon the resistance (friction) which the conductor offers to the passage of the electricity. Again, as with a pipe, this resistance depends upon the size of the conductor and its material (the material being, however, a much more important factor with the conductor than with the pipe).

At this point the analogy fails, as the resistance of the same conductor is constant regardless of the volume of the electric current, provided the temperature of the conductor does not vary. A large current will heat a conductor more than a small one, and by so doing will increase the resistance. So that in the last analysis the analogy does not fail.

It is a universal law of all fluid motion that if the units be properly chosen to agree with one another the volume of current = $\frac{\text{the motive force (pressure)}}{\text{the resistance (friction)}}$.

This simple formula is at the base of the science of hydraulics as well as of electricity, but in hydraulics it is of very little direct use, because, as before stated, the friction depends on the velocity of flow; and the flow and friction being interdependent, calculations regarding them become very complex.

With electricity, however, if the temperature be maintained constant, the resistance is constant, and in practice the range of temperature allowable before damage ensues being small the effect of heat on the resistance is small and the above formula becomes practical. It is, in fact, used as the base of all electric current calculations. If we make

C = volume of current,
E = electro-motive force,
R = resistance,

the formula as expressed above in words becomes when expressed in letters (algebra)

$$C = \frac{E}{R} \qquad (1)$$

which may be transposed to read

$$R = \frac{E}{C} \qquad (2)$$

or to

$$E = R\,C \qquad (3)$$

In which formulas the current is supposed to be measured in amperes, the resistance in ohms, and the electro-motive force in volts.

7. IN DEALING WITH water we have not only pressure and volume of flow per unit of time, but we have their product, viz., power. Consider a water pressure engine in operation. Obviously (the pressure in pounds per square foot), multiplied by (the cubic feet flowing per minute), is equal to (the work done per minute) in foot pounds, thirty-three thousand of which are equal to one horse-power.

Just so with electricity, (the number of volts) multiplied by (the number of amperes) is equal to (the work done per second) in watts. Assigning the symbol W to watts this law expressed by formula is

$$W = E\,C \qquad (4)$$

Seven hundred and forty-six watts are equal to one horse-power. That is, a dynamo delivering seven hundred and forty-six watts of electric power and operating without loss would consume one horse-power, or a motor consuming seven hundred and forty-six watts of electric power without loss would deliver one horse-power, that is

$$HP = \frac{746}{E\,C} \qquad (5)$$

The watt is, however, too small for most commercial requirements and in commercial electricity is multiplied by one thousand, and the resulting unit is called the kilowatt.

In dealing with water the gallon is a definite quantity of a tangible substance. The pressure can be directly referred to, and accounted for by, the weight of the mass. In dealing with an intangible manifestation like electricity how shall we assign tangible expression to its properties? The unit of resistance forms a connecting link with matter and it is defined by making a certain length and size of a standard material the standard of resistance.

The electrical congress at Chicago in 1893 declared that the resistance offered by 14.4521 grams of mercury at 0 centigrade of a constant cross section and 106.3 centimeters long should be the unit of resistance. This is the only tangible electrical unit. The value of the others is determined by the mechanical or chemical effects they can produce; just as heat, for instance, is measured by the expansion of solids or evaporation of liquids, and a mechanical equivalent for heat has been determined which establishes the exact relation between heat and work.

8. A MORE DEFINITE idea of the dimensions of these various units may be had from the following facts:

A mile of ordinary telegraph wire has a resistance of fifteen to twenty ohms per mile, say one ohm per one hundred yards.

The resistance (R) of a common sixteen candle power incandescent lamp is about two hundred and fifty ohms when cold and about one hundred and fifty-three ohms when hot. Note that the resistance is least when hot, which is the reverse of the case with metal conductors. At a pressure (E) of ninety-eight volts such a lamp requires a current (C) of about sixty-four one hundredths of an ampere.

$E = R\,C$ or $97.92 = 153 \times .64$ (3) § 6

The watts per lamp will amount to about sixty-three

$W = E\,C$ or $62.72 = 98 \times .64$ (4) § 7

The lamps per horse-power will amount to about twelve

$$HP = \frac{746}{E\,C} \text{ or } 11.9 = \frac{746}{98 \times .64} \qquad (5)\ \S\ 7$$

The current of an arc lamp of one thousand candle power will amount to five amperes or more; of two thousand candle power to about ten amperes. For a continuous current the pressure will be forty to fifty volts; for an alternating current it will be from thirty to thirty-five volts. Thus it will be seen that an arc lamp consumes from one-third to two-thirds of a horse-power.

* There is but one practical mechanical unit to which the ampere is parallel, viz., the "miner's inch," so called. This latter varies through a wide range of value in different localities, but in all cases it refers to a quantity of water flowing in a given time. Thus if a hole one inch square is cut through a two-inch plank the hole being six inches below a constant water level, it is evident that equal quantities of water will escape in equal times; in this case about ninty-five cubic feet per hour. This constitutes a miner's inch.

Note that these lamp data take no account of losses in the line circuit.

These units reduce to unity together. In other words, if the electro-motive force be one volt and the resistance one ohm, the current will be one ampere, and the power one watt.

9. ELECTRIC CURRENT. It has been stated that we have no knowledge of the existence of anything which can be called a current of electricity, and yet electrical literature is not only full of this term, but its direction of movement is constantly referred to as though it were known. This usage dates from the researches and speculations of Benjamin Franklin. Franklin experimented with the old frictional electric machine illustrated in Fig. 7, in which A is the glass cylinder, B the rubber and C the collector

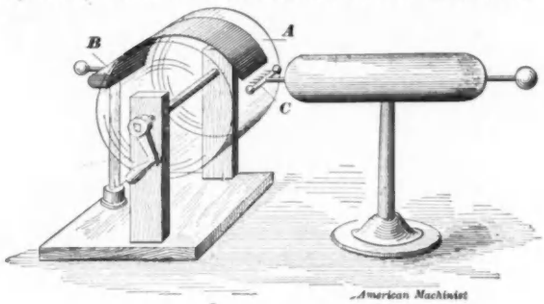


Fig. 7.

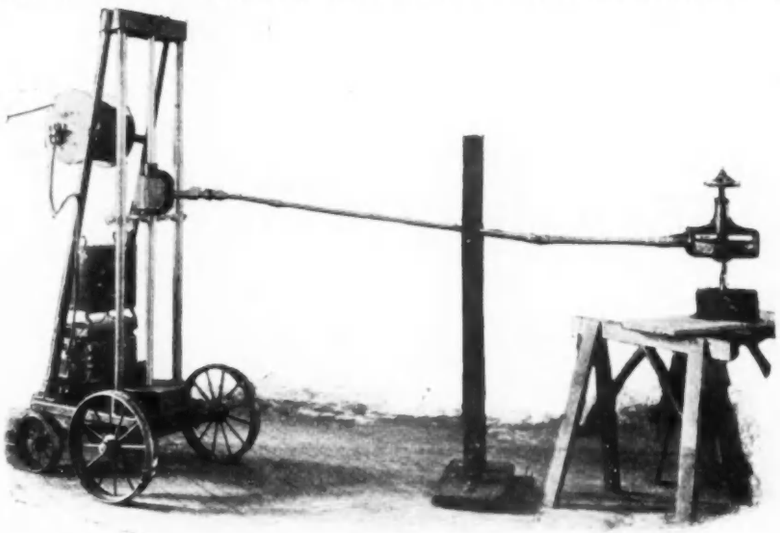
or "prime conductor." With this machine the rubber and collector were found to give electrical manifestations which, though similar, had many points of difference. Franklin, in formulating his "single fluid theory" and opposing the "two fluid theory" assumed that all objects were normally charged with electricity to a neutral point which we may compare to the level of the sea. He then assumed that the glass cylinder abstracted electricity from the rubber and delivered it to the collector, so that by the operation of the machine the former had less than the normal charge, or was negatively charged, and the latter had more or was positively charged. When a communication was established between them the charge was naturally supposed to flow from the positively to the negatively charged body. A positively charged body may be compared to a reservoir of water placed above the level of the sea and a negatively charged body to a similar reservoir placed below the level of the sea.

In point of fact, Franklin had no more reason for assuming that the glass cylinder abstracted electricity from the rubber than that it put electricity into it, but this assumption, or at least his conceptions of positive and negative electricity and direction of electric flow have survived apparently for all time.

The galvanic battery produces electricity which differs from that of an electric machine only in being of enormously less electro-motive force and enormously greater volume. The electricity from the two poles was found to have the same difference of character as that from the rubber and the prime conductor, and thus the terms positive and negative pole and direction of current became associated with the battery. The dynamo is but a third means of producing electricity, and to it the same terms are naturally applied. It should be thoroughly understood, however, that in the light of present knowledge or lack of knowledge these terms are simply convenient conventions and probably convenient fiction.

Portable Electrically Driven Drilling Machine.

The machine illustrated herewith was designed for drilling and reaming the numerous bolt holes about locomotives, which require to be drilled or reamed after the main parts of the engine are assembled. Such holes are those by which the saddle is bolted to the smokebox and the foot plate to the frames, as well as the miscellaneous holes for attaching the various brackets to the frames. The machine is also used on the holes for bolting the pedestal caps to the frame jaws, which holes being lengthwise of the frame are not capable of being drilled under an ordinary drill press. Taken all together, the number of holes in a single locomotive to which the machine applies is approximately one hundred, the average diameter being from 1⅛ to 1¼ inches.



PORTABLE ELECTRICALLY DRIVEN DRILLING MACHINE.

Without the aid of some such machine as this, these holes are necessarily made by hand with a ratchet brace.

The construction is clearly shown in the illustration. On the truck body is an electric motor which through bevel gearing drives the splined upright shaft shown between the vertical frame pieces. Connecting the vertical frame pieces is a vertically adjustable cross piece carrying a pair of bevel gears through which the vertical shaft drives the short horizontal shaft shown projecting through its bearing in the gear box. To this short shaft is connected the telescopic gimbal jointed shaft from which the drill is driven through a pair of bevel gears at its outer end. These gears are properly covered by a gear box which is plainly shown. The last length of the shaft carries a loose sleeve by which it may be held in the hand when in motion. This jointed shaft was adopted after a flexible shaft had been discarded for having too little stiffness in driving for such work, as well as for being subject to injury in case of the drill sticking in its hole.

The drill is usually held and fed to its work by the aid of an "old man," such as is used in ratchet work. This method of application will be plain from the feed screw and hand feed wheel shown. In case of the holes through saddle and smokebox, however, a special rig is used. This consists of a stiff bar with a trunnion at each end, one trunnion being placed in the flue nearest the center of the boiler, while the other enters a hole in the center of a piece of flat iron bolted across the front of the smokebox. The bar is, therefore, practically in the center line of the boiler, and the saddle holes being radial, it furnishes without change of position an abutment for drilling all of them.

The machine is in daily use in the erecting shop of the Schenectady Locomotive Works, where it is considered a great labor-saver. It was designed in its mechanical features by Mr. J. E. Sague, mechanical engineer of the works. In its electrical features it is the work of the General Electrical Co. We are indebted to the locomotive works for the privilege of photographing the machine and for the particulars of its operation.

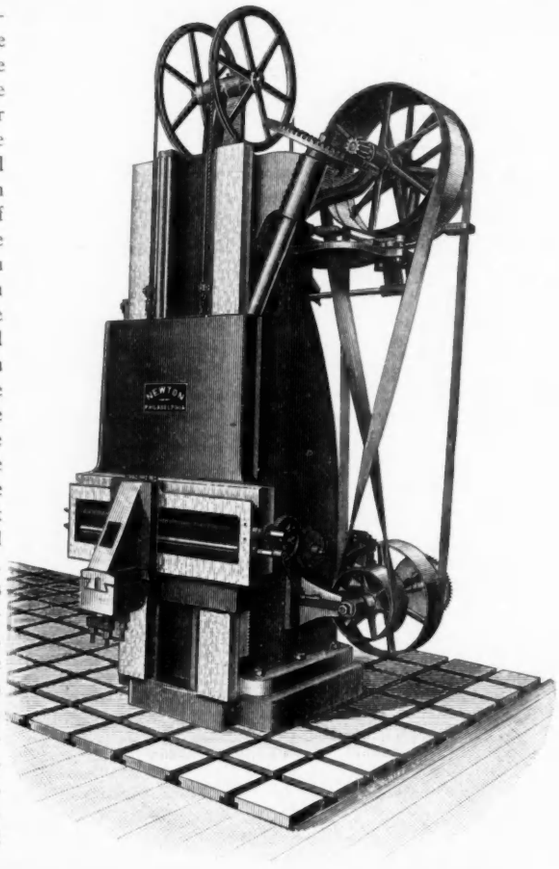
There is no good reason why the machine should not be driven by compressed air as well as by electricity. The air motor would be cheaper and simpler, and in case of need could be repaired at home. The average electrician will at once bring up the question of efficiency. The efficiency of electric motors of this size with a resistance box attachment is nothing to be very proud of, and apart from all that, the percentage of efficiency in such cases is the least important factor that enters into the consideration.

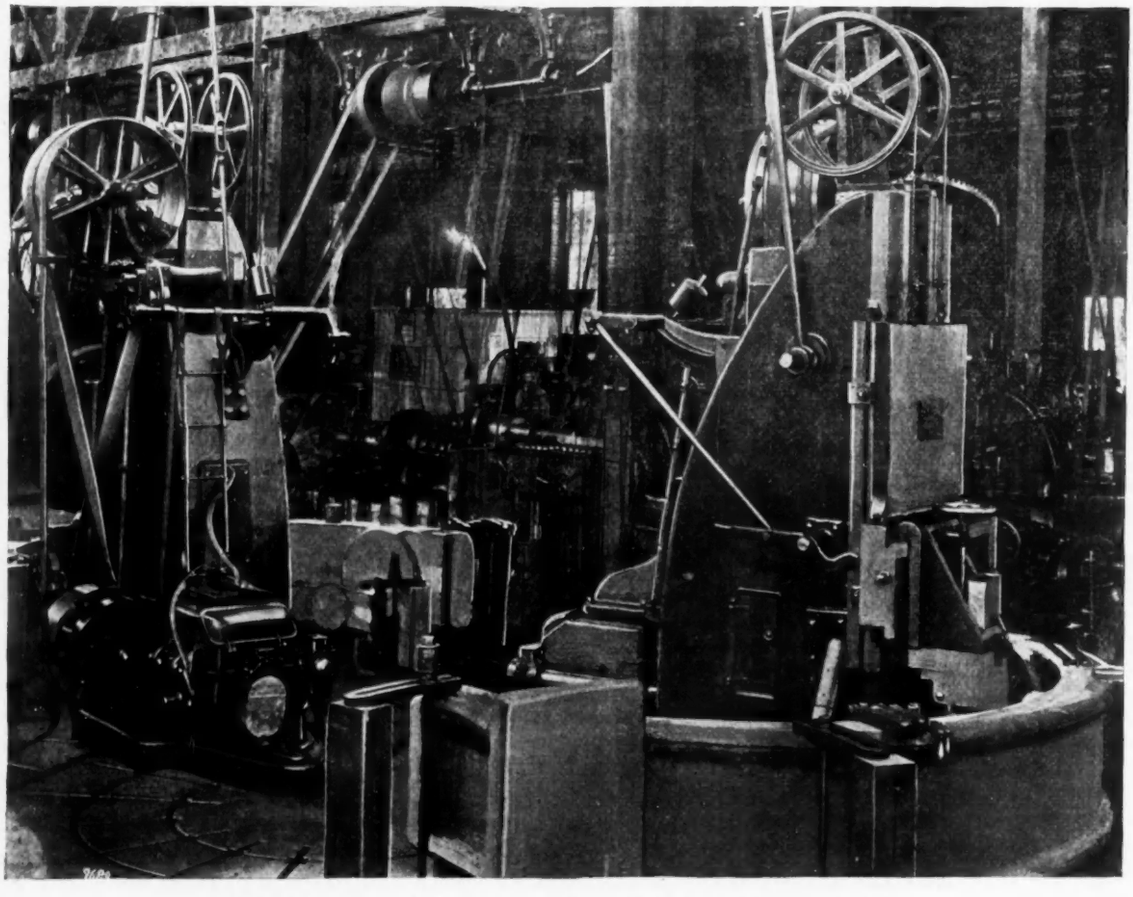
Portable Electrically Driven Slotting Machine.

By the courtesy of the General Electric Co. we are able to present herewith an illustration of a special portable slotting machine, made from a photograph of the machine at work. With this we also give a wood engraving from which the design of the machine will be more clear, while the half-tone will better serve to show the method of operation.

The machine is used for facing the pads or faces on the interior surface of the magnet frames of large dynamos, to which pads the cores of the field coils or pole pieces are bolted. In large direct driven dynamos these magnet frames have become so large as to make very awkward pieces of work to execute by the usual methods. A complete frame is a complete circle, though usually made in halves, and the pole pieces when bolted to their pads on the inside surface of the frame, point toward the center of the frame. In other words, a section of the pads on the frame would form a polygon with the corners missing. In addition to these pads the joints must be machined as well as the feet by which the frame rests upon the base of the machine. One half of a frame will be seen in position in the large illustration, from which the awkwardness of the work when done by the usual methods will be apparent.

This illustration shows two of the slotting machines in different views. They stand upon a large floor plate provided with suitable T slots by which the machines can be secured in any desired position. Each machine is driven, as shown, by an electric motor mounted



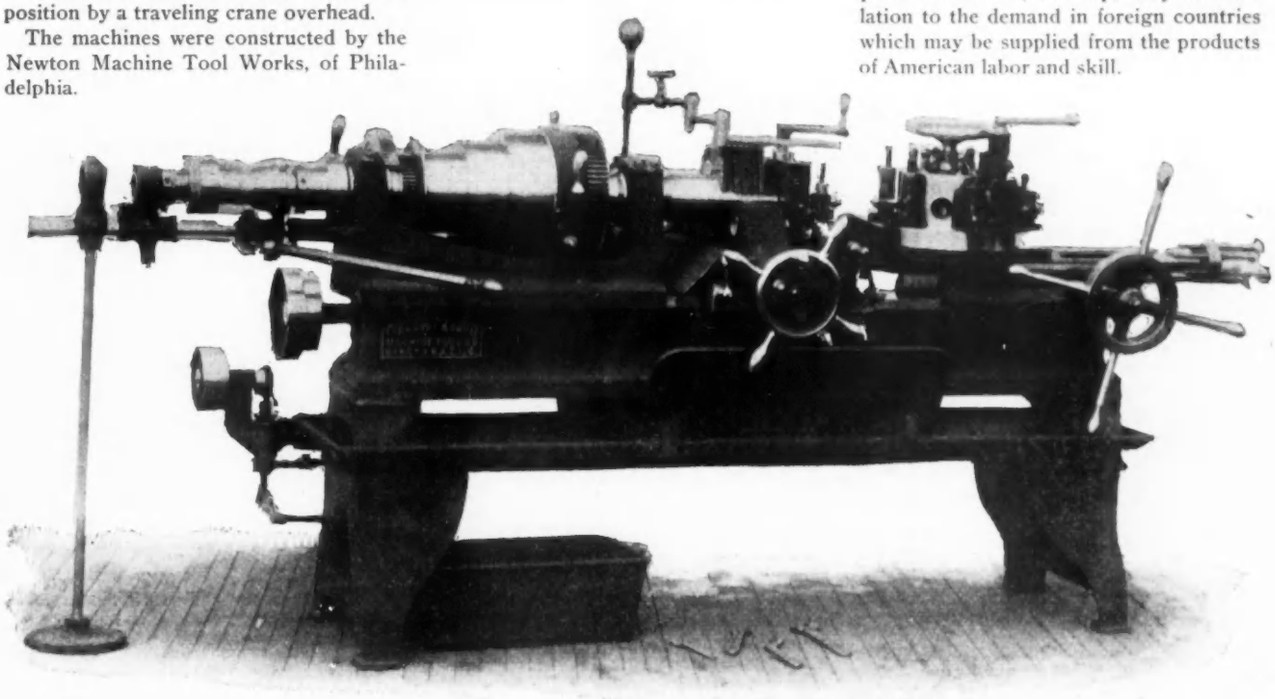


PORTABLE ELECTRICALLY DRIVEN SLOTTING MACHINE.

upon its base, the electric drive being particularly well adapted to this case by reason of its flexibility in permitting changes of position. It will thus be seen that electricity furnished in this case both the problem and its solution.

The T slots in the floor plate are arranged in several sets of circular form. They are not, however, used in any way as an index plate to bring the tool to its work. The circular arrangement was simply adopted as the most suitable for the work to be done. In the operation of the machines the work is laid off with dividers, straight edge and scriber, and the slotter is then brought to the proper position to "hew to the line" and is secured there. In case of need or convenience the machine may be shifted in position by a traveling crane overhead.

The machines were constructed by the Newton Machine Tool Works, of Philadelphia.



Hub and Cone Machine.

We give herewith an engraving of a machine especially adapted to making bicycle hubs and cones, and so arranged that although it is, as shown, special in character, it is made so by the addition of special features to a regular screw machine, into which it can again be converted in a very few minutes, should occasion require it.

The special features consist of the rest for forming hubs and for holding them while being cut off the bar. There are two forming tools, one for roughing and the other for finishing. They are placed opposite each other, and are fed up together by the same screw, which is "right and left," with one part slightly coarser pitch than the other, so that just as the roughing tool finishes its cut, the finishing tool overtakes it and completes the forming. Both tools are of regular forming tool style, and are ground across the ends without change of form. The rear tool does the roughing, and is serrated to break the chips.

The steady-rest, or guide, for the bar is mounted on the same base, and is fitted with a pair of phosphor-bronze jaws, to avoid marring the finished surface of the hub. These jaws are operated by a right and left-hand screw, and will grip stock from ½-inch to 2⅛-inches diameter.

The cutting-off rest is attached direct to the turret, taking a bearing on the bottom flange, and can be brought in position to cut off the first hub while the third one is being formed, thus consuming no separate time for the cutting-off operation.

The turret of the machine is of entirely new design, being arranged at the bottom with an extension having T slots into which ordinary tool posts or other fixtures can be put, and tools thus held will in many cases do away with the necessity for box tools. A T slot runs entirely around the turret, allowing a tool to be placed in any desired position, and, as an instance of its usefulness, it permits a tool to be set so that it forms a cone while the hole is being drilled through it.

The turret is provided with a separate stop for each hole, the screws being fitted to a disk which is automatically revolved with the turret and moves with the turret slide. Thus the tools can be set approximately correct, and the stop afterwards adjusted for each separately.

Both the hub forming tools and the turret are fed automatically and have automatic stop.

The machine is now made with a two-step cone for a 5-inch belt. Its builders are the Lodge-Davis Machine Tool Co., Cincinnati, Ohio.

Proposed Commission of Foreign Commerce.

The following bill has been introduced by Representative Doolittle, which has for its object the establishment of a foreign commerce commission. The bill is a lengthy one, but the following are the principal points:

The establishment at the seat of Government of a commission of foreign commerce, the general design and duties of which shall be to acquire and diffuse among the manufacturing and commercial people of the United States all the information on subjects connected with foreign commerce, in the most general and comprehensive sense, and especially with relation to the demand in foreign countries which may be supplied from the products of American labor and skill.

This commission shall be under the charge of a commissioner of foreign commerce, who shall be appointed by the President, by and with the advice and consent of the Senate; the office shall be held as long as the occupant is efficient, and he shall receive a salary of $5,000 per annum and actual traveling expenses incurred while necessarily traveling in the discharge of the duties of his office. There will be a sufficient number of clerks to transact the business of the office.

Some idea of the magnitude of the bicycle industry may be gained by contemplation of the fact that one ball making concern, the Cleveland Machine Screw Co., is now making balls in bicycle sizes at the rate of 600,000 per day, and has orders for 104,000,000 for this season. They expect this season's output to reach 125,000,000, for which will be required about 200 tons of tool steel.

Condition and Prospects of the Machinery Business—II.

Letters from Machinery Manufacturers to the "American Machinist."

Last week we published a number of letters from leading machinery building establishments on the condition and prospects of the machinery business. Below we print a second instalment of them.

American Gas Furnace Company, the "American" Oil Gas Machine, Gas Blast Furnaces, Heating Apparatus, High Pressure Blowers, etc., Complete Fuel Gas Plants for all Manufacturing Purposes, 80 Nassau street, New York.

Our sales have nearly doubled as compared with 1894, and the prospects for 1896 are excellent. Independently of the general improvement of business, we owe a large part of our orders to the constantly increasing number of manufacturers whose attention has been given to the importance of a systematic application of heat in facilitating and improving the production of all kinds of metal work.

Through our agents, Messrs. Chas. Churchill & Co., Ltd., London, England, our export trade especially has increased steadily and with rapid strides, probably owing to the fact that in England the application of gas heat (and power) is greatly developed, and every new device for economizing fuel and making heating operations thoroughly reliable is gladly adopted.

Our domestic trade consists mainly in the erection of oil gas plants, including every apparatus required for making the gas and using it with economy and efficiency for any kind of work requiring heat. Each one of our customers has become our friend and an efficient advertiser of our work. All have spoken with satisfaction of our system.

We must express our appreciation of the value of your esteemed paper as an advertising medium. We have certainly made a large number of sales directly due to our ad. in your columns. The war cloud having passed—as it had to before the light of common sense—we think that the "American Machinist," and its clientage of thoroughly practical common sense people, will join with us in praying that Congress and the Executive will let us alone to do our work in peace, and unhindered by outbreaks of partisan folly. Our mechanics alone can "lick the world," if let alone, and that is glory enough for at least the present generation.

Armstrong Bros. Tool Co., Armstrong Patent Tool Holders for Turning, Planing and Boring Metals, Dealers in Machinists' Tools and Supplies, Chicago, write us:

All through 1895 we have had hard work to keep ahead of our orders, and just now we are about two weeks behind. We ourselves are somewhat surprised at the rapid increase in our business—each subsequent month for the last two years showing a substantial increase in sales over its predecessor. While we are pretty well satisfied with 1895, we confidently expect to more than double the amount of business for 1896, and with this in view we are now placing in our shop machinery that will more than double the output. The prices of labor and material have gone up about 10 per cent., but there will be no increase in the price of our products for '96.

We will, during the coming year, get out a full line of all kinds of tool holders, so that soon there will be as little need of forging a lathe or planer tool as there now is of forging a drill or reamer.

With best wishes for the continued success of our old standby, "The American Machinist," and wishing all connected with it the compliments of the season.

The Berlin Iron Bridge Co., Engineers, Architects and Builders of Iron and Steel Bridges, Buildings, etc., East Berlin, Conn.

Our business for the first half of 1895 was about as poor as it well could be. For the latter half of the year it has been excellent, as we have had all the work we could do.

We have taken advantage of the dull times and low prices in all classes of machinery in the past year and a half to make very important changes in our plant, the effect of which changes on our product we have just commenced to feel. In the past six months we have averaged 1,500 tons of finished material per month, although formerly our product was but 900 tons per month.

For the coming year we anticipate a good business. Improvement will be slow, but we believe it will be sure.

We believe now that the political affairs of the country are in somewhat of a more settled condition, and the fears of legislation adverse to manufacturing interests are not anticipated, that business will develop. We also have in mind that the large production of gold, both in this country and South Africa, is going to be a great stimulus to business throughout the world, increasing values in every line of business. We believe that almost everything now in the market is cheap at present prices, and anticipate next year at this time prices in all lines will be very considerably advanced.

Charles H. Besly & Co., Fine Tools, Manufacturers' and Machinists' Hardware, Seamless Tubes, Sheet Brass, Copper and Brass Wire, Chicago, Ill.

Helmet bronze for springs, Helmet babbitt for bearings, Gardner grinders for grinding flat surfaces, all of which we manufacture, have sold better in '95 than ever before, and the advertisement in your journal has helped us do it.

Our trade is in good condition, and we expect even better trade in '96.

Boston Gear Works, Gear Wheels and Cuttings of Every Description, Boston, Mass.

We have found business for 1895 as good as we predicted last year. We have not yet enlarged our plant, except that we have added a few special tools that will enable us to bid much lower than formerly, especially on large contract work.

We shall soon issue our 1896 catalogue, which we expect will be more comprehensive than our 1894 issue.

We predict a good year for 1896, barring out all unusual contingencies.

Brown & Sharpe Mfg. Co., Machinery and Tools, Providence, R. I.

Our business during the present year has been considerably larger than in 1894. The number of hands employed January 1st, 1895, was 782, and they have been gradually increased till 1,148 are now at work. The whole establishment has run ten hours per day throughout the year, with occasional overtime.

A building, 115 feet long and 53 feet wide, for annealing and case-hardening, has been recently added to the works.

Thirty-three old machine tools were taken out during the year and 109 new ones added.

Builders' Iron Foundry, Founders and Machinists, Providence, R. I.

Our chief impression with regard to 1895 is that the year, for us, has been one of preparation. We have built and equipped a shop which enables us to better handle our architectural iron work. We have renewed and extended our arrangements for fire protection and for lighting and heating our machine shops, and new tools have been added to the machine shop.

Our associates, the Rice & Sargent Engine Company, have completed patterns for a line of their standard engines, from 75 to 1,000 h. p., and we have made patterns and drawings, and gotten out and tested sample machines for a line of grinding and polishing machinery. In connection with this we have developed a countershaft with belt-shifting device, which is unusually ingenious, positive and durable.

Our books, however, show that, aside from the preparation for larger business, in several respects the year has been gratifying. Our sales have been satisfactory in pattern work, in architectural iron work, globe specials for water works, and for the machine work required by our principal customers. In some of these lines the sales have been the largest in our history.

The least satisfactory part of the business has been in the demand for large castings, 15 tons and upward in weight. The demand for smaller castings has been about as usual. The first of the year we started with 240 men, 8 hours, but soon increased to full time; and during the latter portion of the year have been running several of the departments at night, with 400 men.

The advance in prices has not kept pace with the advance in material except in a few instances, so that we look for slightly higher prices in most lines, but no very radical advance.

Cincinnati Milling Machine Company, Machine Tools, Milling Machines, Universal Cutter and Reamer Grinders, Cincinnati, O.

The year 1895 has been an exceedingly busy year for us, our sales being fully 50 per cent. larger than in 1892. During the year we have added to our building, increasing the working floor space about 50 per cent., and are just completing a new warehouse, wash room for the men, and offices. Have also added largely to our shop equipment. The price of labor and materials for the year have uniformly been higher, and the prices of our product firm. At present we do not contemplate any further additions to our plant, but will add several sizes to the new line of milling machines brought out during the past year.

R. M. Clough, Special Machinery and Tools, Gear Cutters, Tolland, Conn.

Business with me the past year has been very poor indeed. The last two months it has improved somewhat, and in fact orders usually come in more the last three months of the year. I hope business will revive the coming year, but I cannot say that I really expect very much improvement for at least another year in business in general.

I am about sending out a new catalogue of gear and milling cutters, and expect it will be ready January 1, 1896, also I have some improvements under way in the manufacturing of milling cutters.

Coffin & Leighton, Machinists' Improved Steel Scales, Syracuse, N. Y.

We have recently moved our shop to a better location. We will soon place some new tools upon the market.

Our sales for the past six months show a marked improvement over a corresponding time in either '93 or '94.

We think the coming year will be a prosperous one with us.

Crescent Steel Co., Fine Tool Steel, Polished Drill Rods, Springs, etc., Pittsburgh, Pa.

The past year's business has been an improvement on 1894, and noticeably so in the demand for our finest products. There has been little change in the price of these, as it has not been possible to make much reduction, using, as we do, such a large quantity of high grade Swedish iron, the prices for which are generally steady, and always high. We have continued our policy of improving our product wherever possible, even at increased cost to ourselves; and our efforts in this direction have been liberally recognized by consumers of fine steel. The outlook for 1896 is encouraging, though we do not expect more than a good, steady business, with a probable increase in the cost of material for the commoner grades of steel.

The Deane Steam Pump Co., Holyoke, Mass.

During the past year we have enjoyed a slightly larger volume of business than in 1894, but the prices have continued too low to make the business profitable. During the past six months, however, prices have been advanced by us, and several of our competitors have followed our lead in this direction. During 1895 we have added several new types of pumping engines to our already long list. Vertical and horizontal types of power pumps for electric motive power are most notable among these additions. In this department we are very busy, having just completed a water works pump of about one million gallons' capacity, the pump being a horizontal duplex, with electric motor on the same base directly connected to the pump by a train of gearing. We are now building four larger pumps of similar design, with motors and gear on same frame, these machines being for mining work. Besides these we have a large number of orders for small electric pumps.

We have also built two new types of high duty water works pumping engines—one a vertical Corliss cross compound; the other a horizontal triple expansion engine. We have on our books orders for several large water works machines, including two vertical triple expansion six million gallon pumps for the city of Schenectady.

We have added several large tools in our machine shop, and have improved our entire equipment by general renovation, and especially by installation of the latest improved small tools. We are just about to place contract for an extension to our buildings, by which we will be able to produce our work to much better advantage. We are anticipating a good year in 1896.

Ferracute Machine Company, Presses, Dies and other Sheet Metal Tools, Bridgeton, N. J.

During the first four months of the year business was very dull, but since May we have been running full handed and have more than doubled our force of employés. For several months past we have been running evenings, and a night gang part of the time. This unusual rush of business, however, has been mostly on account of the sudden increase of the bicycle trade. Our general business has been good, and we have added patterns for a number of new styles of presses and other sheet-metal machinery. At the present time we have a large number of orders in ahead, and are fitting out several large factories with outfits of presses, dies, etc.

We have not added much to our shops or machinery, but have reorganized our working force and added a number of jigs and other special tools, together with some little hoisting apparatus.

We have raised the wages of our employés about 8 per cent. from the prices that were paid a year ago. Materials have probably advanced from 5 per cent. to 10 per cent. The sheet-metal business generally seems to be prosperous, and the outlook is good for a fine trade next year.

Flather & Co., Machine Tools, Nashua, N. H.

Business has been good during this year, and we have not been able to supply the demand for our smaller sizes of engine lathes and screw machines. We have at the present writing some three months' orders ahead.

As to the prospect for next year, we do not know. We are not expecting so large a demand for small tools, but in all probability more for the large sizes.

We have added to our plant during the year a number of special tools, and increased our floor space about five thousand feet.

Geo. B. Grant, Gear Wheels, Calculating Machines, Lexington, Mass.

The gear business is rather lame, but mending slowly after the hard times. Something doing always.

The calculating machine business is booming. A score of years ago the merchant sniffed at paying a hundred dollars for a "plaything" to write his letters with, but now he is behind the times if he has not a typewriter. Just now he is sniffing at paying half a hundred for a plaything to do his calculating and adding with, but twenty years hence he will be behind the times if he does that sort of drudgery with his head. You can write a letter with a pen, and you can calculate with a pen, but the typewriter and the calculating machine have come to stay.

Jones & Lamson Machine Co., Flat Turret Lathe and Equipments, Springfield, Vt.

Our business continues to run almost exclusively on the flat turret lathe. Our sales this year will exceed by 20 per cent. the output of 1892, and the monthly average will equal the monthly average of the first six months of 1893. Prices of labor and product have remained unchanged since 1891.

The bicycle boom has indirectly increased the orders for our lathes, but railroad orders have been scarce.

We expect to get a little more business next year.

Landis Bros., Tool Builders, Universal and Plain Grinding Machines, Waynesboro, Pa.

Our business for the year 1895 has been satisfactory, especially in the latter part, which shows largely increased sales over any time heretofore in our experience; and we are pleased to say that the outlook for the future is very promising.

Grinding, as a method of finishing, is rapidly gaining favor, and the demand for our machines is much increased. With many recent improvements to our grinders we hope to merit a continued increase in sales.

Lodge & Shipley Machine Tool Co., Engine Lathes, Drills, Turret Lathes, Shapers, Pulley Machinery, Standard Machine Tools, Cincinnati, O.

Sales the first six months of 1895 were more than double the similar period of 1894, and in the second six months of 1895 sufficient to make the year two and a half times as great as 1894. We are running every night until nine o'clock, have a large volume of orders on hand, and are preparing for a good business in 1896. Our machine tool equipment has been improved by the introduction of nineteen new machine tools. We are confining ourselves to lathes, screw machines, chucking lathes and drills. Included in our line is a 12-inch engine lathe for bicycle work, with very large hollow spindle, not screw cutting nor back geared, raise and fall carriage, and with a simple and effective automatic stop. Our engine lathes run from 12-inch to 42-inch swing, all containing our improved system of change gears for change of feed and screw cutting. A screw machine taking 2¾-inch through the wire feed and weighing 4,200 pounds, has proved a great success with the bicycle trade for their heavy parts. We have also brought out an improved bicycle hub machine. We have also gotten up a full line of drills, from 12-inch to 42-inch, including a triple spindle drill for bicycle work. We have increased our floor space by the addition of a wareroom 120x100 feet, and expect, January 1st, to add another manufacturing floor 75x96 feet.

Maris Bros, Cranes, Portable Hoists, Overhead Track, Trolleys, Philadelphia, Pa.

The early part of the year was bad, the latter part good, and prospects for next year much better. We have paid more attention to jigs and special tools for cheapening and improving our work as wages incline upward, and material, while at present lower than a short time back, will, we think, stiffen up in the early part of next year. The outlook in our line is promising—we do not expect a boom, but a steady and wholesome improvement.

Norton Emery Wheel Co., Emery Wheels and Grinding Machines, Worcester, Mass.

1895 business has been first-class, and we have never known it to hold up so well in December as at present. The net volume of business is 33⅓ per cent. better than last year (1894), and 20 per cent. better than the best year we ever had before (1892).

Prospects for 1896 appear to be good; prices of labor are somewhat higher; product and materials about the same as last year. We have not enlarged our buildings, but have made many interior changes and additions in the way of improved machinery and appliances for better and more economical production, and have a larger force at work than ever before. Have been running evenings until 9 o'clock for about three months.

The Pratt Chuck Co., Drill Chucks, Seamless Steel Ferrules, Clayville, N. Y.

We are glad to be able to say that our business for 1895 has been far more satisfactory than we expected. Our sales of drill chucks have largely increased. We have received many more orders from old customers, and have added many more new names to our books. In our drawn work we have made large additions to our line of ferrules of every description, bicycle parts, etc.

Although prices of steel have advanced very materially, we have been able to furnish our work at about previous figures. We look for an increase in business during the coming year, and have prepared ourselves for it by improvements in our methods and the purchase of new machinery.

Pratt & Whitney Company, Machine Tools, Hartford, Conn.

The first four months of the year our business was much below the average, but since then the shipments have been higher than at any previous time since we have been in business, amounting up to December 1st to more than our best year heretofore. If the December shipments are as large as last month our shipments this year will be 25 per cent. greater than any year heretofore, and about double that of last year.

In January, 1895, we had on our pay roll 800 names. We have at the present time 1,160.

We have added to our plant a 100 h. p. boiler and a 50 h. p. engine, and about 25,000 feet of floor room; present orders cannot be filled entirely before March 1st. The prospect for the next year is good.

In 1893 we reduced the wages of our men and also the prices of our tools. We have not increased the prices for our production this year, but let them remain where they were under the last reduction, in almost every case, but we have generally restored the old wages to our men.

There was quite a rise in the price of pig iron and steel and iron bars, but the tendency is now toward lower prices in these materials and also for copper.

A. D. Quint, Turret Drilling Machines, Hartford, Conn.

My business was dull for the first five months of the past year. In June there was an increase in demand, owing in a great measure to the rapid development of the bicycle trade. There was a slight set back in September, but business improved in October, and is now in volume nearly equal to the good times before the panic of 1893, and I hope to see this continue.

There is a small increase in the cost of labor and material, while the finished product remains the same.

In the way of new tools during the past year I have adapted a reversing tap holder to the No. 2 turret drill, which is automatic in its action, making a complete drilling and tapping machine without the use of a backing belt.

J. E. Reinecker, Machine Tools, Relieving Lathes, Special Tools and Machinery, Chemnitz-Gablenz, Germany.

My business for the past year has been a very good one in all respects. In small tools as well as in machine tools for toolroom and general manufacturing purposes, I failed to fill the want in spite of considerable enlargements of my works. While in beginning of the year I employed 300 men with 285 machine tools, I am now running 340 machine tools with 375 men 11 hours per day, but I cannot see my way to keep up with the demand. I still continue to improve and enlarge my facilities, prospect for business for a long time to come being more promising than ever.

Sebastian Lathe Co., Engine and Speed Lathes, Machinists' Tools and Supplies, Cincinnati, O.

The year now drawing to a close has been, so far as the number of orders received, most satisfactory. From the beginning of the year to the present time we have been running a full force full time, and from present outlook we are convinced that the demand for the coming year will be even greater than at present.

Wages and material are both higher than at this time last year, but prices of our output have not advanced in the same proportion, consequently the margin is smaller, but by reason of the large increase of sales over the preceding two years we are enabled to close the year with a very considerable degree of satisfaction. Smaller margins impel us to use greater care as well as more improved and advantageous methods of production, and these prove virtually a benefit, both to the manufacturer and to the user of machinery.

We confidently look forward to a gradual and healthy improvement of business, and believe that the new year will prove even more satisfactory than the one we are now leaving.

T. Shriver & Co., Iron and Brass Foundry and Works, 333 East Fifty-sixth street, New York.

The business of the year now closing has been rather better than that of 1894. Very few important changes in prices of material have taken place; a moderate advance in the price of foundry pig iron is one of the most decided.

We have found during the year that the "American Machinist" is a good medium for advertisements.

Standard Tool Co., Machinists' Small Tools, Athol, Mass.

The year just passed has been one of constant care and anxiety, owing to the condition of the market lacking the element of stability. Merchants fear to place orders beyond their immediate wants, for fear of a cut in prices, with a corresponding loss to themselves. The prices of manufactured goods are largely what the manufacturer makes them. It has been the policy of some manufacturers in our line of goods to make prices to suit the customer—anything to get an order. Goods have been sold at cost of production. It has been our policy (and we see no reason to depart from it) to make honest goods and sell at living rates. When we cannot do that we propose to close out our business and rest from our labors.

The year just winding up finds us in a good healthy condition. Our plant has been in constant operation and we have added to our line. The wage question we have been wrestling with for the last two years, but as yet are opposed to curtailing expenses by placing the burden upon our employés. The price of material has averaged low, and we have given our customers the benefit of it, otherwise products remain as heretofore.

Stover Novelty Works, Wood and Iron Working Machinery, Freeport, Ill.

Our business has been good the past six months, and is still increasing. This is mostly due to the large demand for light and special machines, especially in the bicycle line, for which we have put out several practical machines, one of which is an assembling drill and the other an automatic drill. At times we have been many orders behind. We have several other machines for the manufacture of bicycles under way, which will be out later, and for which we expect a large demand.

Our sales are largely due to advertising, and if business continues picking up, by spring we will be obliged to enlarge our works.

Thomas Wrigley, Engineer and Machinist, Manufacturer of Special Machinery, Chicago, Ill.

This has not been a very successful year for me in any of my lines. But I have no complaints to make. I am glad I am alive, and hope this next coming year will be better. I am well pleased with your paper and the results for the last year.

LETTERS FROM PRACTICAL MEN.

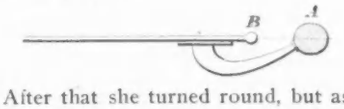
A Cast-Iron Surprise—Hanging a Door, Etc.

Editor American Machinist:

The article under the above heading in your issue of December 5th is extremely interesting. Any remarks upon the same must also, in a dim and distant kind of way, come within the same region of interest; therefore I write.

With reference to the bulging, there is no reason to suppose that the cast iron rim was compressed. The bulging seems to have been due to the leverage of the projecting web. When the contraction of cooling came on, the right hand side of the wrought iron ring in Fig. 3 was compressed. The left hand side of the same ring pressed the edge of the web inward, and the leverage of this bulged out the center of disc.

The second problem proved very disturbing to my mental equilibrium. It haunted me at night and led to a dream. I seemed to see Uncle Peter spread out over the floor making his sketch. But, quite out of the program, old Aunt Sally appeared on the scene overlooking him. As he lifted his head, he met her gaze, and quickly retreated into a corner. Then the old lady scratched upon the wall the following figure.



After that she turned round, but as no one seemed to understand what she was about, she waxed indignant, and with a marvellous flow of language she explained that A was a counterbalance which threw the center of gravity to the fulcrum B. She showed that the single or double columns were only obstructions in the passageway, that the trolley was unnecessary and Uncle Peter's apparatus quite superfluous.

Then, as her audience appeared still

unappreciative, she let herself go. She showed that this method of counterbalancing was as old as the Pharaohs, when it was used in Egypt for the purpose of raising water, and in India for the purpose of hooking people into the air for religious ends. She explained that with such counterbalancing the trap door would stand open at any position in which it was placed, and that this was the simplest and best arrangement possible.

But the calculating man gazed with an abstracted air, and Uncle Peter seemed going to sleep, when, seizing her broom (in illustration) and accurately counterbalancing it, as she had explained, she darted the sharp end at Uncle Peter, and the sweeping end at the calculating prodigy, while in the general confusion which followed I awoke.

W. A. CARLILE.

A Power Test.

Editor American Machinist:

We recently made an indicator test to determine the power required to run 2,500 feet of line shaft, and obtained as a result sixty-two H. P., under the following conditions:

Shafting varied in size from 1 11-16-inch to 2 15-16-inch diameter. Speeds ranged from 75 to 525 revolutions per minute. Most of the shafting was pretty heavily loaded with pulleys. There were 175 counter shafts, with belts running on loose pulleys, counters still.

Of belts there were one 24-inch, one 18-inch, fifteen 12-inch, five 10-inch, and fifteen 4-inch to 8-inch double belts, besides a large number of small belts.

We also had running ten exhaust blowers, taking an aggregate of 20 H. P.

At the first test, made with engine and three head shafts only running, power required was 18 H. P.

Deducting 20 H. P. for blowers and 18 H. P. for engine and head shafts from 62 H. P. leaves 24 H. P. required to operate line shaft, or an average of 0.96 H. P. per 100 feet.

Comparing this with the result obtained by Messrs. McCabe & Woodruff, of Winsted, published in your issue of November 14th, shows a large error somewhere.

Their average at first test, with ordinary bearings, was 4.17 H. P. per 100 feet, and with roller bearings was 3 H. P. per 100 feet.

The statement made at the end of the article, that one man could easily turn the whole line of 600 feet by taking hold of a 35-inch pulley, is sufficient proof that an error had been made. The probabilities are that the wheel does not give anywhere near the power estimated, although a mistake might have been made in testing with the brake, and there was probably a very much larger percentage of gain than appears, which would be a still greater inducement to consider the value of roller bearings. I see your correspondent, Mark Talcott, criticizes a former article of mine I have no desire to argue the question, but, from observations covering over twenty-five years, I see no reason to change the statements made. R. L. A.

Hartford, Conn.

Something More About Levers.

Editor American Machinist:

Don't use your lever (strap) to keep the work from slipping. Use the straps to hold the work down only. The resistance to the cut should be taken by plugs in the holes of the planer platen, or something that cannot move under the severest cut.

It doesn't take much of a strap (lever) to simply hold the work down, except in special cases, as when the work is very high. W. L. C.

Large Iron Stacks.

Editor American Machinist:

Referring to item on iron stack, page 970 of issue for December 5th, you may find in Waterbury, Conn., one 66-inch stack 105 feet high, 19 tons weight, two 60-inch stacks 100 feet, and possibly others. The above were erected in 1892.

G. D. COLTON.

Waterbury, Conn.

Engine Governors and Bursting Fly-Wheels.

Editor American Machinist:

In number 52 is an article on engine governors and engines running away and bursting flywheels, and the suggestion is made that a shaft governor might prevent this as there is no belt to break or slip.

In the first place, it is a very difficult thing to make a shaft governor with a single valve that will close the valve sufficiently tight when running with a light load and with a vacuum so that the engine will not race. The lead has to be taken off and compression put on, so that the coal required is a big item.

The way some of these engines will run when a large load is thrown off is sometimes frightful. The writer is putting a condenser on a set of this type of engines now, and it is a question whether it will be possible to use a vacuum when the light load comes on. On one pair of this style of compounds it was safe to carry only 22 inches of vacuum, as with 24 or 25 they would not stay in the building for more than a short period. This, too, after two weeks spent working at the valves and getting them in the best shape to run with a vacuum. It should also be borne in mind that some of the most disastrous flywheel accidents have occurred with this class of engines.

With the ordinary fly ball governors the power required to drive them is very light and the belts used are largely in excess of the size required. It is exceedingly rare that trouble comes from the belt, and there should never be any occasion for it, and when it is, it will usually be found that the man in charge has become afraid that it would slip, and has made it so tight that the strength has all been stretched out of it, or it is completely soaked with cheap grease so that it is rotten. The same skill that would get a governor belt in either of these conditions, would soon have a shaft governor in such a condition that the builders would never recognize it.

The speed of an engine will depend somewhat on the manner in which the valves are adjusted between the high and low pressure cylinders. It is evident that the governor at its highest point should shut the steam entirely out of the cylinders. This is done by tripping the valves before the ports are opened. Care should be taken, however, that the valves on the low pressure side close first, for two reasons: one, that the steam shall cease to work in the low pressure, so that the speed shall not be accelerated by using up the receiver pressure, and second, that the receiver shall be full, so that the low pressure shall take hold as soon as load is put on.

Some builders put a valve in the steam pipe and an extra governor attached to it. Should anything happen to the governor that is regulating the speed of the engine, and the speed be accelerated two or three revolutions above the normal, this extra governor, that is always hunting for trouble, will shut off the steam entirely.

There is one thing that none of these appliances will control, and that is, the changing of the polarity of one of the generators when two or more are connected together in direct connected work, thus transforming one of the generators into a motor. If such a not improbable thing should occur on a direct connected or a belted direct generator, it would be the natural thing to see that engine go to pieces, either with a belt driven or a shaft governor.

There is a chance to improve some of the belt driven governors, as it is too often the case that the speed will change from four to six revolutions. One thing that causes this is, that the travel on the spindle is too far, and sometimes when less, the arms are brought to such an angle that the balls are pulling straight out from the spindle instead of pulling the collar up. Both of these defects are frequent. Too short a movement would be followed by a jumping governor, but if the governor has two inches of movement it is sufficient.

W. E. CRANE.

Waterbury, Conn.

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☞ *Every correspondent, in order to secure attention, must give his full name and address; not necessarily for publication, but as a guarantee of good faith.*

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Machinists in the Navy.

Our attention has been called to the fact that machinists in the engineer department of the navy have grievances to which we should give some attention. We shall do that in due time, but are convinced that machinists can not get proper recognition in the navy until the department to which they belong first secures proper recognition and standing.

In this connection it may be proper to call attention to the fact that the pretended interest of "the line" in machinists is humbug, pure and simple, and the only reason for this pretended interest is that it is thought machinists would be more easily suppressed and kept down than engineer officers who have had training at Annapolis can be.

The real feeling of "the line" for machinists is shown by an order issued June 15th last, under which machinists, instead of receiving $70 per month pay are divided into three classes, only one of which receives $70, the other two getting $55 and $40 respectively. This order, like most all other orders, was issued, we may be certain, on account of line influence and shows very clearly what the friendship of "the line" for machinists amounts to. Most machinists have had special training as to the comparative value of actual performance and mere "kind words."

So unattractive have machinists' positions in the navy become that, when the new cruiser "Indiana" was to be manned, no machinists could be secured to serve on board of her, and in order to get the necessary number the North Atlantic squadron was called upon to furnish them and from each vessel of the squadron a number of men were taken for the new vessel—men already enlisted who had no choice in the matter and were as well off on the Indiana as elsewhere, probably.

Another curious and very unjust feature of the new regulations is that, under them, a machinist who has served one term of enlistment and has been advanced to the first grade, must, if he re-enlists, begin at the bottom again and wait for promotion, unless he immediately re-enlists, or happens to be assigned to certain special or exceptional service.

Engineer officers who have been through Annapolis and have had the same military and other training there that has been received by line officers are better prepared to contend for the rights of the engineer corps on board ship than machinists possibly can be and that explains why line officers are so very anxious to show that the steam engine department of a naval vessel should be in charge of machinists, and that no engineer officers should be aboard the vessel.

A Steady Job for the Machinist.

In the signs of the times there are portents which should make the machinist feel cheerful, and it may not be at all inopportune to call his attention to them, now that another year is beginning. The machinist at this time, even as other men, is a little given to forecasting his future, and to wondering what the progress of events will open up for him. Of one thing he may be assured, whatever else the future may have for him, it has at least a plenty of work. Whoever in the good time coming is to find his occupation gone he is not the man.

It is said that Mr. Edison was predicting, the other day, that work would be abolished in another generation, that our only labor in the future would be the pushing of buttons. Things do seem to be tending that way. Muscular exertion is less and less a factor in the accomplishment of human aims, although our plans and our achievements grow continually. Steam helped to liberate the hewer of wood and the drawer of water, and now electricity not only continues this work directly, but also enables the steam engine to vastly increase its field of usefulness.

Of the work that the horse was wont to do, there has never been so much of it going on as now, and yet, as we all know, there was never a time when the horse was of as little account. His practical disappearance from the highway is almost assured, and now it is threatened to drive him also from the fields. The work of the farm is hard work for man and slow work with the best of horses, but electricity in the crowded old world is showing its handiness in plowing and reaping and thrashing and all the work, both heavy and light, with which the farm abounds.

But electricity is only one of the many developments of the times entirely dependent upon mechanical construction. It is simple enough to "push the button," but the button maker, with all that the button implies, must be there both to make and to maintain it. The steam engine almost created the modern machinist, and electricity now still more demands his services. Electricity is doubly dependent; the machinist must fabricate the dynamo and the steam engine must give it life. Then, entirely independent of both steam and electricity, other means of power generation, transmission and application multiply continually, and, whatever they may mean for other men, for the machinist they can only mean increased activity and a growing importance. There was probably never a time like the present and never a field of human activity like that of mechanical construction wherein the changes were so many, so radical and so necessary. Wherever the new succeeds the old the machinist's hand is always employed to shift the scenery.

All human progress, now and evermore, involves machinery, and back of it the

machinist. The "art preservative" is not the art supreme, although it would fain grasp all the honors. To produce, to achieve, is greater than to record or to perpetuate the memory of events.

The Kane-Pennington Engine.

It will be noticed upon perusal of the second article upon the Kane-Pennington engine, in our present issue, that our correspondent professes to give all that is at present known concerning this remarkable engine. We do not know anything certainly as to the efficiency of this engine as compared with other oil engines, and the account of tests and the sample indicator cards given do not throw any light upon this point. It remains, however, that this engine is apparently by far the lightest engine yet made for the power developed, and it is eminently adapted to the special use for which it was designed.

Equity and Safety in Boiler Practice.

The account which we gave, last week, of a recent law suit between boiler builders and boiler users seems to be a story with a moral. In fact, we doubt not that most of our readers will find at least two lessons in the facts as presented. Attention seems to be called to the obligation which the purchaser and user of any device or article of manufacture is under to the maker and seller to use the article with reasonable regard to the proper conditions involved. It may not be generally possible to enforce this obligation by legal process, but it certainly seems to exist. Every article is bought for a purpose, and in the purchase the purpose is assumed to be secured, and the seller, tacitly or with more or less explicitness guarantees it. If the thing does not accomplish its expected purpose the presumption is against the integrity of the seller and the reliability of his product, and his business suffers; but if the failure in accomplishment is on account of the improper use of the article the general public may still see only the apparent culpability of the seller, when in fact he is innocent, and then he has a serious cause of complaint against his customer.

It would seem that a case like this should seldom occur, because it is clearly to the customer's interest to use the article so that the best results may be secured, and the honest seller has usually found in this sufficient protection. Polonius might have had a boiler purchaser in mind when he said:

"To thine own self be true,
And it shall follow, as the night the day,
Thou canst not then be false to any"—boiler maker.

But here our second lesson comes in. The users of boilers are not always true to themselves. They are not always well informed, or informed at all, as to the conditions essential to the safe, satisfactory and economical generation of steam. In the cases of some large companies, who are popularly supposed to be constituted without souls, that is unfortunately not their only deficiency. The mental mechanism which controls the selection of the responsible operatives would seem to be, if not deficient, at least defective, and if not defective at least peculiar and abnormal in its operation. Of the personnel in the above case we are absolutely ignorant, and we can only judge in a general way that for some reason not apparent the management were not true to themselves, and consequently could not be true to anyone concerned.

Questions and Answers.

Name and address of writer must accompany every question.

Questions must pertain to our specialties and must be of general interest.

We cannot undertake to answer questions by mail.

(6) S. H. Z., Harrisburg, Pa., writes: There are two ropes, equally strong, and each 100 feet long. The one is tied to a fixed post, and twenty men tug at the other end of it; the other rope is not tied, but has ten men at each end. Now, on which rope is the stress or strain greater? A.—The first named rope is subjected to just twice as much stress as the last named.

(7) C. W., Lafayette, Ind., asks: 1. Will a locomotive pull the same number of cars backward as when in forward motion? A.—As a general thing a locomotive will pull as much one way as the other. Where it will not do so, the difference is due to some arrangement of the valve motion, which gives opportunity to work more steam or to work steam more advantageously in one direction than in the other. Road engines usually have no provision for using sand when running backwards. 2. Will a stationary engine pull the same load as well when running under as when running over? A.—Yes; a stationary engine is usually able to work as well in one direction as the other. They are usually run over, but the late Mr. George Corliss preferred to run under, on account of the effect in relieving the guides of the weight of the crosshead and connecting rod.

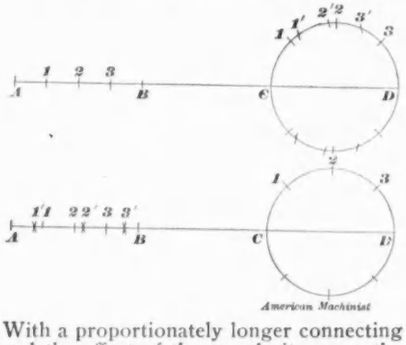
(8) J. A., Woodcliff, N. J., asks: 1. In setting an Allen valve, is it the same as a slide valve, or does it require less lead? A.—As the Allen valve has two openings instead of one, the lead should be a little less than for the plain slide valve. 2. If the forward eccentric strap should break on a small marine engine, what could be done so as to reach port? A.—Repair the strap, or substitute something for it. If the outer half of the strap should break beyond repair, it might be possible to hold the other half to the eccentric by means of a spring attached to the valve rod joint. A spring might be improvised out of an oar, or something similar. As to devising some other valve motion, we would prefer to have a sketch of the engine. 3. Which is the most reliable rule for safety valves, in regard to figuring their blow-off points? A.—See answers to questions Nos. 370 and 396, 1895.

(9) E. J. A. asks: 1. Do not automatic cut-off valves, which control speed, by changing their travel, throttle the steam at ports when engine is lightly loaded? If so, does not this reduce the efficiency of engine? A.—The efficiency is no doubt reduced by this means, but every style of engine, of course, has its point of best efficiency, and in none of them is it found when the engine is doing the least work. 2. Will you please give a rule for computing area of steam ports in stationary engines? A.—Where the same port is used for both steam and exhaust, as with a slide valve, the computation should be made with reference to the exhaust steam, as, on account of the expansion, the volume of steam to be discharged from the cylinder is much larger than the volume which is admitted. The port should have such an area that the escaping steam would have a velocity not exceeding 6,000 feet per minute. See "Slide Valve Gears," by F. A. Halsey.

(10) R. B. Smith sends a proposed electric alarm for the protection of safes, and asks if it could be tampered with, without sounding the alarm. The safe is surrounded by a cabinet of wires, all in circuit, and containing a considerable (unknown) resistance. The alarm bell is arranged to go off with either an increase or a decrease of the current. The battery and one bell are located at, say, the cashier's house, while another bell is located at the police station, and our correspondent has been told that by short-circuiting the line near the battery and "manipulating the battery somehow," the bell at the police station could be prevented from ringing. A.—We cannot see how the alarm could be beaten by the method described. Short-circuiting the line near the battery would increase the current at the cashier's house, and decrease the current at the police station, thus ringing both bells. The only way we can see for beating the alarm, is to cut out the resistance of the cabinet surrounding the safe, and cut in another equal resistance, when the cabinet could be opened with impunity. A suitable switch would cut out the cabinet and cut in the substitute so quickly that the bells would not ring—the magnetization being renewed before the inertia of the moving parts could be overcome. The fact that the resistance of the cabinet is unknown would not give security, as it could be determined from voltage and current measurements. Of course, the resistance connections could be made more or less inaccessible, but we infer that our correspondent asks about the security of the electrical features pure and simple, without reference to mechanical safeguards.

(11) J. W. S., Pensacola, Fla., writes: 1. Please give me some information as to the effect of the angularity of a connecting rod on the travel of the piston, and if the same effect is not produced also on the valve travel, and state cause for same. A.—As to the cause, we can dismiss that at once by simply saying that it is so, just as two and two are four, and nobody knows the cause. The figure below illustrates the effect of the angular action of the connecting rod upon the piston stroke. *A B* represents the travel of the center of the crosshead pin, and the circular line represents the travel of the center of the crankpin. The points 1, 2 and 3 represent respectively one quarter, one half and three quarters of the travel of the crosshead pin, and a quarter, a half and three quarters of the corresponding half

revolution of the crank. The length of the connecting rod is *A C* or *B D*, in this case equal to twice the travel of the piston. If now, referring to the upper diagram, we take the length *A C* and measure from the points 1, 2 and 3 on the line of travel of the crank pin, we find that the other end of the rod will not come at the points 1, 2 and 3, as it should do to have equal measurements of the crank for equal portions of the piston travel, but will come to the points marked 1′, 2′ and 3′, and this effect is due to the angular action of the rod. In the lower diagram we take the same length of connecting rod and measure from points 1, 2 and 3 of the crank path to the line of the cross-head travel, and we find the points 1′, 2′ and 3′, none of which coincide with the quarters of the stroke.



With a proportionately longer connecting rod the effect of the angularity upon the travel is less. As the length of the eccentric rod is usually much greater than that of the connecting rod, while the travel of the valve is much less, the effect of the angularity of its own rod is not much felt by the valve, but it is constantly in a false position on account of the angularity of the main rod. 2. We have an Ide tandem engine, compound, jet condensing, running in an electric plant at 280 revolutions per minute, and there is a knock in the low pressure cylinder which sounds as if it was water. I claim that it cannot be water, running at that speed, with 120 pounds of steam and a short steam pipe. Can you tell me the cause of the knock? A.—Without more knowledge of all the conditions it would not be safe for us to offer an opinion as to the cause of the trouble. There is, however, no apparent reason why it might not be water.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 32.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patents, write Walter Donaldson & Co., Wash. D.C.

Model making and electrical experimental work. F. W. Gardam & Co., 58 Ann st., N. Y.

Aluminum and Brass Castings, Machinery, Name Plates. Twining Campbell, Paterson, N. J.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Engine castings, ½ H. P. up; best designs, finest castings. Catalog. Grant Sipp, Paterson, N. J.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

A book for superintendents. "Hawkins' Calculations" (descriptive), $2.50 postpaid. Catalog free. Theo. Audel & Co., 91 Liberty Street, N. Y.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N. Y.

Duplex and special gear cutters, counterbores, cutter and surface grinders, vertical millers, hand punches and shears. R. M. Clough, Tolland, Conn.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 161 Washington street, New York; 139 East Pearl street, Cincinnati, O.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-books; the set of 92 papers sent to any address in the United States for $5. American Machinist, 203 Broadway.

Some Recent Inventions in Metal-Working Tools and Machinery.

It will be the purpose of this and subsequent articles to briefly describe a few such

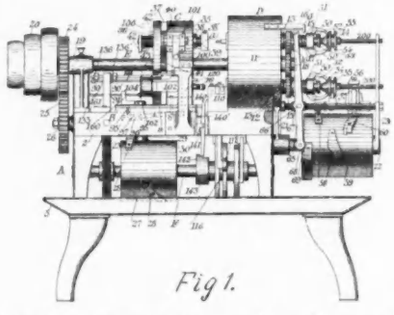


Fig 1.

inventions as relate to metal-working and allied machinery.

An improved screw machine is shown in Figs. 1, 2, 3 and 4, a construction recently patented by R. Hakewessell and E. C. Henn, of Hartford, Conn., and designed more particularly as an improvement on a like machine, the invention of Mr. Henn. The essential features of the present invention are the slotting saw and auxiliary turret, and these are so devised as to be capable of attachment to the former construction, by means of a few changes.

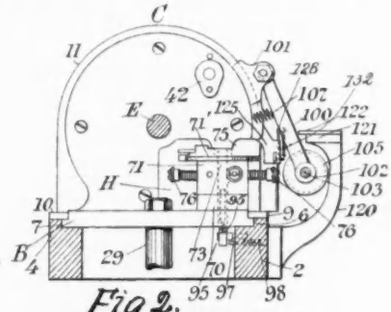


Fig 2.

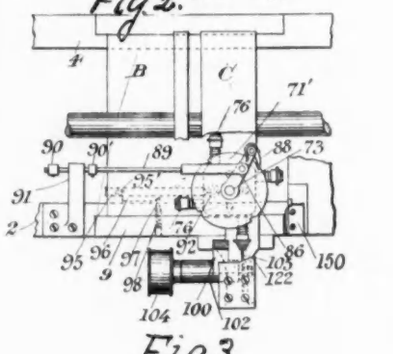


Fig 3.

A brief description of the construction and operation of the machine as a whole will be necessary to an understanding of the improvement.

Through the cone pulley 20 are driven directly, by the shaft E, the threading die a, and the stock chucks 13, of which there are four. Indirectly, through 24, 25, 26, bevel gears within the bed, a transverse worm and the worm-wheel 23, are driven the toolhead-sliding cam 27, the chuck opening lever 140, the cutting-off tools (by cam 116 and levers 117), and by gears within the leg at the right-hand end of the bed, the stock-turret spacing sector 21, and the feeding and stock-chuck manipulating cam 59. The stock is fed against a stop in the lower position at the rear, is shaped by a box-tool directly behind a, threaded by a and transferred to the slotting chucks directly below a.

To accomplish this, the head C is longitudinally reciprocated, while between the successive operations the stock-holding head within the frame 11 is intermittently rotated. In the threading operation, a revolves, driven by clutch 38, while the head is advancing, the stock being meanwhile held. On the backward movement of C, 38 unclutches and a is held by 42, 42¹; the stock at this moment being rotated to unscrew it from a. Thus far, the construction is that of the patent to Mr. Henn, above referred to.

The screw-holding turret, which forms more particularly the subject of the present invention, is shown at 71 in Figs. 2 and 3, 71¹ being an attached ratchet plate by means of which the rod 89, stops 90 and 90¹, arm 86 and pawl 88 effect the spacing. Fig. 3 shows the turret with the head C in their retracted position, at which time only the turret spacing is effected. The usual turret-locking mechanism is shown somewhat imperfectly at 95, 96, 97, in Figs. 1 to

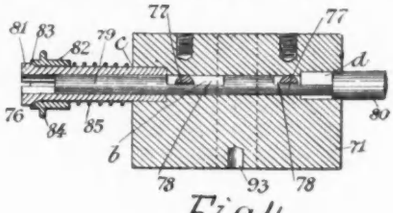


Fig 4.

3. The slotting saw, driven by an independent belt, is carried on the swinging arm 100 pivoted to the sliding head C, so that both turret and saw reciprocate together.

On the forward movement of the slide, the following operations take place: The spacing arm and pawl, held by an arm 91 on the main frame, are withdrawn to engage the next notch of the turret; arm 140

retracts sleeve 84 (Fig. 4) of that chuck 76 which is in position, as appears in Fig. 1, allowing this chuck to open and receive the screw just before it is severed from the stock. Cam 143 is so timed as to allow the chuck to grip the screw as soon as severed, and before the turret is revolved. Meanwhile, the saw-carrying arm, moving

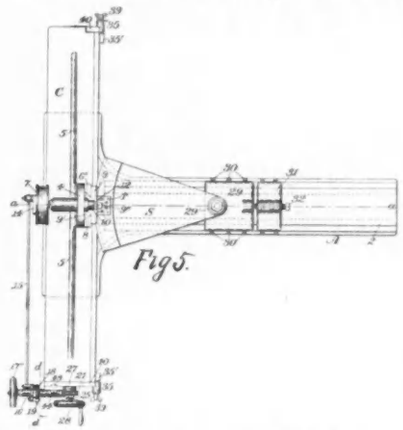


Fig 5.

with the turret, has been engaged by the toe 122 of a cam piece carried on the arm 120, fixed to the machine bed, and has pressed the saw forward to do the slotting. In the next chuck, the rod 80 (Fig. 4) has contacted with the piece 150 (Fig. 3) and has ejected a finished screw. The ejector

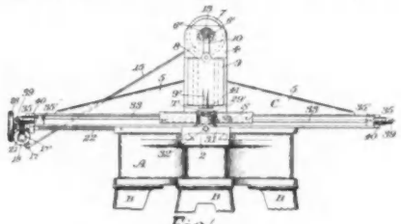


Fig 6.

rods run loosely through the turret so as to be retracted by the entering screw, and are "halved" over each other, as shown, to bring all the chucks into the same horizontal plane. The fourth chuck remains idle.

On the return motion of the head C, the first movement unlocks the turret and dis-

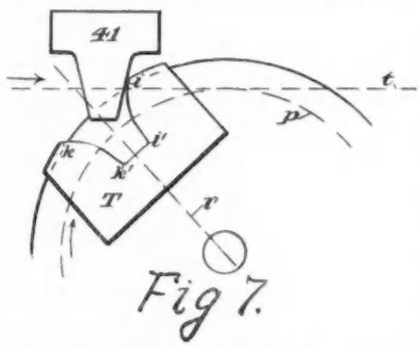


Fig 7.

engages the saw arm from the cam 122, the spring 107 (Fig. 2) throwing the saw from the slot. Further movement throws forward the pawl arm, giving the turret a quarter turn. During the slotting the screw head is centered and held by a slide, shown imperfectly at 128 (Fig. 2). This slide is advanced by a bevel-ended rod 133 (Fig. 1) and retracted by a spring.

Figs. 5, 6 and 7 illustrate in plan and end elevation, and diagrammatically, a machine for shaping a theoretically correct involute curve, for gear-tooth templates, or for the teeth themselves. This is accomplished by giving transverse travel to a head carrying a reciprocating shaping tool and retaining in exact synchronism therewith the rotation of the template-carrying table. The device is the invention of Mr. C. C. Tyler, of Hartford, Conn.

The machine comprises a T-shaped bed or frame, along the shorter arm of which travels the tool-carrying head C, while on the longer arm is adjustably centered the template-carrying sector S. The cutting tool 41 is carried by a slide 9, actuated by the pulley 7, crank pin 6 and connecting screw 22, working through a fixed nut in rod 10. The table C is traversed by the bed and driven by the rod 15 and intermediate pawl, ratchet, worm and wormwheel, as will be clearly understood from the figures.

Two "flexible bands," probably steel tapes, 33, 33 (Fig. 6) fasten each at one end to the outer ends of the table C, and at the other end to the opposite sides, respectively, of the sector S. Straining screws 35, with thumb-nuts 39, are provided for keeping the tapes at all times taut. Thus it will be seen that the speed of any point in the circumference of S must be exactly equal to the rate of rectilinear travel of the table C.

As shown by the dotted arc near the curved end of S, a ledge of the sector overhangs and is supported by the table C, while the parts 29 and 31 show the manner of accurately adjusting the centers of sectors of different radius on the longer leg of the bed.

Fig. 7 shows diagrammatically the manner of preserving a fixed relation between cutter and work, while allowing the one to travel in a straight line and the other in an arc. It also shows the manner of shaping the adjacent sides of two consecutive teeth.

The Lesson of the "St. Paul" Accident.

The coroner's jury in the case of the accident to the steamer *St. Paul* seems to have done its work intelligently and well, measured by the customary standard of procedure in similar cases. Ample proof was furnished of the soundness of the piping, and of its strength to stand the full working pressure, and it further appeared that the drainage apparatus had received the customary attention, and by competent judges had been considered, before the accident, adequate for the duty devolving upon it. That the means of drainage were inadequate the accident fatally proved.

The jury found that death was due to asphyxia and scalds, resulting from the rupture of the steam pipe, the cause of which it did not name. The verdict concluded as follows:

"We find that the said rupture was not caused by the neglect of the steamship company, or of any of its employés. We further find that the main steam pipes and the stop valves pertaining to the same were and are properly constructed to safely bear the intended working steam pressure of 200 pounds per square inch, and that the pressure on the boilers and pipes did not exceed 130 pounds at the time of said rupture. While we find that the system of drainage of the main steam pipes and stop valves is that usually provided on steamships, we recommend that the drain pipes on the main steam pipes and stop valves in question be enlarged to allow better drainage."

The apparent increase in the frequency of steam pipe explosions has led quite generally to the belief that they are to be attributed to the higher working steam pressures that are now so commonly employed. If they are due to that cause, they are not usually directly so. The experiments by German naval engineers, detailed in our last week's issue, showed that all the conditions for a disastrous explosion may coexist with very moderate, or what would now be considered low, steam pressures. With a boiler pressure of 70 pounds, the pressures in the pipes under the action of water hammer were shown by gage to run up above 2,000 pounds, and the pipes were ruptured in the experiments as they are ruptured in the terrible accidents which are from time to time reported. All who are in any way responsibly connected with the designing or operating of steam apparatus should make themselves familiar with the conditions of danger, and see that they are avoided.

A Railroad to Peru.

The Peruvian Congress has confirmed and extended privileges to Cuthbert B. Jones, a citizen of the United States, and his associates, to construct and operate a railway, starting from any point on the Pacific Coast between the parallels of Chota and Huanchaca, and extending to the eastern limits of the Department of Cajamarca. Exclusive privileges are granted for twenty years after the completion of the line, which is to be constructed in five years, excepting the Intercontinental Railway, which shall be privileged to cross the line or lines to be constructed.

The attainment of the expectations arising from this exceptional concession, would present very substantial foundations to carry out the recommendations of the International American Conference held in Washington in 1890, relative to the establishment of a steamship line from San Francisco to Valparaiso and intermediate ports. Such a line would quickly open a vast commerce between the United

States and the Pacific Coast of South America. This concession may exercise no little influence in the expansion of American trade, if American capitalists should find it profitable to undertake its full exploitation.

The people of Peru seem very desirous to facilitate and encourage American capital and enterprise, and the action of the Peruvian Congress in this matter has been well received.

Literary Notes.

A TEXT-BOOK OF FREE-HAND LETTERING. By Frank T. Daniels, A. M. B., Instructor in Civil Engineering in Tufts College.

This little book of thirty-four pages and thirteen folding plates sets forth the elementary principles of the formation of letters, and their combination to form words, and of the arrangement of words to form titles. It begins with preliminary exercises which offer preparation in manual skill and in the estimation of values. It is free of rules and arbitrary expedients, and in their place gives reasons from which the student makes his own rules. Variety, as much as is consistent with thorough practice, in fundamental styles is also given.

The book is well adapted to the use of schools where technical drawing is taught, and for the use of draftsmen who wish to become proficient in rapidly making good and plain figures for the dimensions of an object, and plain lettering for any remarks that may be required on the drawing—all of which in working drawings is equal in importance to that of drawing the outline of an object.

The book is published by D. C. Heath & Co., Boston, Mass.

STAND-PIPE ACCIDENTS AND FAILURES IN THE UNITED STATES; A Chronological Record of Accidents to and Failures of Water-Works Stand-Pipes in the United States, with Full Discussions and Assignment of Theories; also a Discussion of Current Practice in Specifications and of Other Related Matters. By Wm. D. Pence, C. E., Assistant Professor of Civil Engineering, University of Illinois.

In this little book the subject of stand-pipe accidents is treated in an excellent manner, and it will be highly appreciated by engineers interested in this class of work. Close attention has been given to all available information bearing upon the conditions and circumstances attending or leading up to the several accidents. Theories are adopted which are not merely plausible, but are probably more nearly in line with the recorded data than any others which may be assigned. A list of references to the sources of information is given at the conclusion of each description for the purpose of independent investigation of cases that might be questioned.

With the exception of a few additions and revisions, the original record comprising the body of this is a reprint of a series of articles which appeared first in "Engineering News." The book contains 195 pages, 6⅞ by 4⅜ inches, including a good index, 37 illustrations and numerous tables. It is published by the "Engineering News" Publishing Co., New York. Price, $1.

APPLICATION OF GRAPHICAL CONSTRUCTIONS TO MACHINE DESIGN. By Dr. Hederich, Engineer.

This is the first volume of a series treating on the application of graphical constructions to machine design. It is written in the German language, and treats principally on the strength and construction of teeth of gears and strength of axles and shafts.

The book contains 43 pages, 9¼ by 6¼ inches, and nine folding plates, table of contents, but no index.

It is published by Hermann Costenoble, Jena, Germany.

LETTERING FOR DRAFTSMEN, ENGINEERS AND STUDENTS; A Practical System of Free-Hand Lettering for Working Drawings. By Chas. W. Reinhardt, Chief Draftsman "Engineering News."

We are all familiar with the orthodox alphabet book, in which some engraver has indulged his skill in producing ornamental letters which no draftsman can imitate, and which no employer would pay him for imitating if he could. This book is not of that kind. It is offered as its title indicates as a help toward the production of quickly executed and presentable free-hand letters, such as all sensible draftmen make or attempt to make. The proper proportions and the minutiae in the form of each letter, which, together with uniform slant and height make good letters, are pointed out, especially with reference to their reproduction by photo engraving. The letters exhibited are claimed to be, and obviously are, actual reproductions of free hand work, and while better than most draftsmen will be able to produce they nevertheless show what can be done with the pen, and what may be fairly aspired to, instead of the usual unapproachable excellence of the engraver's art.

At the conclusion is a plate showing a "round writing" alphabet, and in this connection we think the author might well have included a plate of the letters made with the same style of pen, and in essentially the same manner, but having inclined instead of upright stems. These inclined stem letters are just as easily learned and made as the regular round writing form, while they are more legible and less foreign in appearance. As a friend of ours once remarked, "I like round writing first rate except for one thing—I cannot read it."

The book is 11¼x6 inches portfolio form, and contains 23 pages of text with 8 full page plates and a loose plate of cross section paper for use in lettering tracings. This trick of using cross section paper is not as well known as it should be. By first roughly making the title on such paper without attempting to bring the centers of the different lines of letters in a line, and then shifting the cross section paper below the tracing for each line, these centers are easily brought in line and an evenly balanced title secured with no loss of time from laying out. In this manner, fifteen minutes should suffice for making any ordinary title.

The book is published by D. Van Nostrand Co., New York. Of the price, we are not informed.

Our esteemed contemporary, "The Iron Age," celebrates its fortieth birthday by the issue of a special number in which is presented a great deal of valuable information regarding the metal and hardware trades. A number of tables, diagrams, etc., graphically illustrate the magnitude of the lines of business to which this paper especially devotes itself, and this number particularly emphasizes the fact that "The Iron Age" is a great metal and hardware journal.

At Vienna, not long ago, a trial was had of a pair of safety valves such as are used upon the State railways of Austria, and of a pair of American pop safety valves. They were tried alternately upon the same locomotive. The diameter of the Austrian valves was 4.5 inches, and that of the pop valves was 3.7 inches.

The fires were urged by blast until the valves began to blow, and the rise of the steam thereafter was noted. The Austrian valve showed 37½ pounds above the loaded pressure, while the pop safety valve showed only an excess of 11¼ pounds. The rise in pressure noted occupied 7 minutes with the Austrian valve and 13 minutes with the pop valve. The conclusion was drawn that the pop valve is nine times as effective as the Austrian, and its adoption was strongly recommended.

One of the most important shipments of machinery ever made in this country was by the Baldwin Locomotive Works on the 30th ultimo, and consisted of 20 locomotives for Russia. They were loaded on the British steamer "Turret Day," and will be taken direct from Philadelphia to Novorossisk. The engines are among the largest ever built at the works, and are fitted with special fireboxes for burning petroleum. Some are for passenger, and others for freight service, and 20 more engines will be shipped this month on the same order.

The explosion of a boiler in a printing office seems to have been the prime cause of a series of explosions which wrecked and set fire to a number of buildings in St. Louis on January 2d, and caused the death of eight or more people, and the serious injury of a number of others.

Bids were opened at the Navy Department, Washington. D. C., on January 2d, for furnishing and delivering at the Mare Island Navy Yard one steel crank shaft; estimated weight, 11,600 pounds; to be

delivered within 60 days after date of contract.

The following were the bidders: the Midvale Steel Co., Philadelphia, Pa., 28 cents and 34 cents per pound. Bethlehem Iron Co., South Bethlehem, Pa., 29 cents and 35 cents per pound.

Photographing in Colors.

The indirect method of photography in natural colors of Cros and Ducos du Hauron presents two points of difficulty —the selection of the colors and the preparation and superposition of the monochromatic films. For the preparation of the color negatives the authors make use of orange, green and violet screens, using with each a photographic plate possessing a maximum sensibility for the rays that the screen allows to pass through it. The preparation and superposition of the monochromatic films is attained in the following manner, as described in the "Journal" of the Society of Chemical Industry: A glass plate is coated with a 10 per cent. solution of glue, containing 5 per cent. of ammonium bichromate and 5 to 10 per cent. of bromide of silver emulsion, and then exposed under a negative. After sufficient exposure the plate is washed in cold water and freed from silver bromide with hypo, and in this way a scarcely visible image of insoluble mucilage is obtained, which can be colored with suitable dyes. Three of these monochromatic films, colored red, yellow and blue, each of which has been obtained from the corresponding color negative, are then superposed on the same plate, care being taken to isolate each film from the others by an impermeable film, say, of collodion. This process allows of the relative intensity of the monochromes being varied, or of the addition of a fourth or more films.—"The Engineer," London.

COMMERCIAL REVIEW.

Pittsburg: Retrospects of 1895 and Prospects of 1896.

Not half a year has passed since was current in the newspapers a statement by the president of one of the companies in connection with which Pittsburg is most celebrated, that the demand for iron was then ten-fold more than the production, and that if the public only realized the true situation an actual stampede would ensue. Now people are tempted to go to the other extreme, and talk extravagantly of over-production. Never, probably, was the output of iron so great as at present, and not only is there practically no purchasing to absorb it, but consumers are unwilling to cart off the iron for which they have already contracted. People now recognize that the summer's buying was speculative and abnormal.

The price of Bessemer pig is now as low, in some cases, as $9.90, Valley furnace, which is almost the same as that ruling a year ago. This probably represents nearly, or quite, rock bottom for the pig iron market, but steel billets are not unlikely to see declines from present quotations before reaching their lowest.

The sales during the year 1895 are estimated by the "Pittsburg Dispatch" as follows:

Tons.	Bessemer.	Billets.	Grey Forge.	All Kinds.
1st 3 mos....	312,750	150,650	52,565	681,235
2d 3 mos....	636,420	150,790	73,225	1,123,325
3d 3 mos....	667,925	239,200	113,350	1,252,810
4th 3 mos....	298,450	95,150	28,825	539,953
12 mos.....	1,915,545	644,790	268,965	3,597,323

As compared with this, the sales of Bessemer during 1894 are given at 944,825 tons, showing, for 1895, an increase, in round numbers, of 1,000,000 tons, or nearly 100 per cent.

The cessation of business incident to the holidays and stock-taking leaves the iron men completely at sea, and some of them appear, from the way they talk, to be caught in a whirlpool. For a few days or weeks hence, no one can tell what the future will be, but the following statement of opinion which was secured for the "American Machinist" in the office of Jones & Laughlin, has its value.

"At the beginning of the year, prices of iron and steel were depressed and business was on a low basis. In the spring a change came, and prices went up. They reacted, and we are now in about the same relative position as before. The demand was fictitious. When prices go up high they go down low in reaction. With wise legislation and a financial bill to relieve the present strain of money, we do not see why there will not be prosperity, but prices will probably not be so great as they have been, since last summer they were largely speculative. Billets and pig metal are now below the cost of production and the lowest seems to be about reached. At the present time of inventory, material is not wanted on hand. Next year's market will perhaps be more healthy than that which we have had. Railroads and others are greatly lacking in stocks. There will probably be buying for naval and coast defence construction and a good deal of building is now projected, though perhaps not so much as during the past six months. All we need is confidence."

Mr. John Jarrett, secretary and treasurer of the National Iron and Steel Sheet Manufacturers' Association says: "While, from present indications, the prospect is not very bright, we still have hopes that, as the trade outlook is fairly good, the sheet iron business will share in the general prosperity. From the 15th of January on orders will come in, and we shall then know what business is to be."

Among the factors which may in the future be eagerly watched, as likely to influence the iron market, are (1) National legislation, as to the importance of which opinions differ. (2) Probable naval construction. (3) Buying by the railroads, which, though they are still none too rich, have made increased earnings, and have great necessities. (4) The strong undertone which prevails in machinery and finished products.

After a broad investigation of various branches of the machinery market in Pittsburg, we cannot too strongly emphasize the contrast beween it and the iron market. While the latter has had its boom, and has collapsed, the former has developed no sensational features, but a gradual improvement in volume and tone, and has closed the year permeated with health and quiet confidence. It would be incorrect to say that finished products have sympathized not at all with the depression in raw materials, but they have done so comparatively little; just as they displayed a conservative spirit during the business revival.

The trade of 1895 in general machine tools has been notably better than that of 1894, and has held on well at the end of the season. There was a period of activity in the summer, followed by a somewhat decreased demand after the reaction in iron, but December has been a good month—according to the experience of one firm dealing in machinery, engines, boilers, etc., the best month in four years. General prospects are good, though just now a little dulness is naural. Most of the business comes from shops already established. The demand is not only for the ordinary lines of tools, both heavy and light, but for considerable special machinery. Bicycle manufacturing tools cut a relatively small figure in this market. Prices of machinery, though now rather low, have, in the main, an upward tendency.

Machinists' and mill supplies, too, have shown marked improvement over 1894. The hopeful sentiments of sellers relative to the business that is to follow inventory time, are not suppressed by the weakness in iron, though it is not likely that the moderate advances in price already made can be increased in the face of existing conditions.

A dealer says of twist drills, reamers, etc., that two months ago prices were high, it being difficult to obtain a good article, but that now mills have started up and prices are lower, with a tendency still downward.

In elevating and conveying machinery, for shops, the past seven months have seen a good business. The past few years have brought about a material decrease in prices of these lines.

In wire rope, used for mining and elevator purposes, there has of late been a larger demand than for some time, and a strong undertone rules. The prices have not kept pace with that of iron, but there is an inclination to advance them.

Extensive inquiry among the engine and boiler trade reveals the existence of a feeling of confidence, although not so strong as it was two months ago. The past year has seen quite a satisfactory volume of business. It began early, with a flurry, in January, but the best season was about September. Prices of the ordinary run of these goods went up, and subsequently, when materials fell, reacted to a low or intermediate position. Boilers are hardly down to their old level, but are tending toward it, while engines seem to have little remaining to sacrifice. Among the various uses to which engines and boilers are put in the Pittsburg district may be mentioned blast furnace blowing, rolling mill purposes, cranes and hoists, electric power and lighting. There is also some street railway extension.

H. K. Porter & Co. find that, while business in light locomotives has been better than in 1894, it is irregular, spasmodic and of uncertain tendency.

In steam pumps, trading has been fairly active, though nothing to boast of. The Edward P. Allis company reports having a contract for six large pumping engines for the city of Pittsburgh.

Feed-water heaters are coming into good requisition in this district, owing to the increased cost of fuel.

The higher prices of petroleum which have been attained during the year have set everyone drilling, and the Oil Well Supply Company has found business almost as good as it ever was. Pipe, boilers, etc., for oil operations have been active. Trade is a little quiet now, but, if oil holds its price, the spring is expected to see a resumption on as large a scale as last year.

Electrical goods are having a moderately warm reception in the Pittsburgh market. Besides the ordinary lighting purposes, electricity is coming into use by the mills for transmission of power to cranes, hoists, etc. The Homestead and the Ohio steel works now employ electric motors for rolls and centrifugal pumps. By the application of electricity to machines which are intermittent in action, a generator of only 25 to 50 per cent. of the total power may be sufficient. Trade in dynamos and motors is a little quiet at this season, but the outlook is good, for mills have been earning money and will make improvements.

The one product which, last winter when all else was desperately dull, flourished and prospered, was aluminum. The metal is coming so largely into use as a substitute for brass and for ornamental architecture work and other purposes that the Pittsburgh Reduction Company is multiplying the capacity of its works. The aim of the company is not to hold up the price with increasing demand, but to lower it with lessened cost of manufacture.

Of the hardware trade, the Bindley Hardware Company states as follows: "Business of 1895 has been very much in excess of that of 1894. The values reached a minimum early in the past year. During the spring and summer months there were a few marked advances, some of which have not been maintained, although they have not fallen back to prices ruling early in the year. We feel that, on account of the cost of paid labor, prices of general hardware will not be any less, and if there is a demand, they will be higher, because advances have not been sharp. The outlook is fair; there is a good prospect of building, and the trade talk more hopefully than a year ago. The prices of nails are held up to a high figure by a pool. They are not likely to go higher, and would fall if the pool were to fail."

To sum up: While we do not anticipate for this year a repetition of the sensational features of last year's iron market, we have reason to look for a more healthy business tone and an era of increasing prosperity.

QUOTATIONS.

NEW YORK, Monday Evening, January 6th.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$13 25@ $14 00
No. 2 foundry, Northern	12 50 @ 13 00
No. 2 plain, Northern	12 00 @ 12 50
Gray forge, Northern	12 00 @ 12 25
No. 1 foundry, Southern	13 50 @ 14 00
No. 2 foundry, Southern	13 00 @ 13 50
No. 3 Southern	12 50 @ 13 00
No. 1 soft, Southern	13 00 @ 13 50
No. 2 soft, Southern	12 50 @ 13 00
Foundry forge, Southern	12 00 @ 12 25

Bar Iron—Common, on dock, $1.25 @ 1.35, mill prices for carloads; refined, on dock, $1.35 @ 1.50, mill prices for carloads.

Scrap Iron—No. 1 yard wrought, f. o. b., $12.50.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—$1.85 @ 1.95 for ordinary brands. Special brands upward.

Cold Rolled Steel Shafting—Base, 2½c. in carloads; 2¾c. in smaller quantities; 3c. from store.

Copper—Lake Superior ingot, 10c.; electrolytic, 9¾ @ 9⅞c.; casting copper, 9½ @ 9⅝c. for ordinary stock.

Pig Tin—$13.00 @ 13.10 wholesale.

Pig Lead—In carloads, $3.05.

Spelter—Western brands, $4.00 @ $4.07½ wholesale, New York delivery.

Antimony—In wholesale lots, Cookson's, 7¾ @ 8c.; Hallett's, 6¾ @ 7c.; Japanese, 6¾ @ 6⅞c.

Lard Oil—Prime city, present make, 50 @ 51c.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9"X12", 6" X 9" and 4½" X 6". We recommend the 6" X 9" size for machinery catalogs. When they must be larger or smaller, one or the other standard sizes should be adopted if possible.

We have received from Edwin Harrington, Son & Co., Philadelphia, Pa., a catalog illustrating and describing the new Harrington Hoist. This hoist formed the subject of an illustrated description in our columns some time ago, and in addition to this there are illustrations and descriptions of several other hoisting machines, cranes, etc., and some machine tools built by this concern. It is 4⅝ x 7⅛ inches.

The New Britain Machine Co., New Britain, Conn., sends us a catalog, illustrating and describing their Chain Mortising Machine, which is a machine for cutting the mortises in woodwork, the cutters being links of a chain which passes over a roller, and is forced into and through the wood to be mortised. It is a somewhat peculiar machine, and is claimed to be remarkably efficient. The catalog is standard size, 6 x 9 inches.

MANUFACTURES

The Troy, N. Y., Iron & Steel Company is putting in a large electric plant.

Pickands, Mather & Co., of Cleveland, O., have made contracts for the building of fourteen steel freight vessels, to cost $3,500,000.

The U. Baird Machinery Company, of Pittsburg, has taken one of the few agencies of the Brown & Sharpe Company, of Providence, R. I.

The Brownell Company, of Pittsburg, has installed for the Hamilton Steel & Iron Company, Hamilton, Ont., a complete steam plant of about 2,500 nominal horse power.

The Cateret Steel Co., Jersey City, N. J., has been incorporated to melt ore and manufacture steel. Capital, $1,000,000. Henry A. Jones and Joseph Davis are the incorporators.

The Clinton Motocycle & Power Co. has been organized and will erect shops at Clinton, Ia. We understand they will make vehicles which will be propelled by the Kane-Pennington Motor.

The New Britain Machine Co., of New Britain, Conn., have written us that they are having a brisk trade in their Chain Saw Mortiser and Case Engines, and that they are preparing for increased business this year.

The Boston Blower Co. informs us that in order to facilitate transaction of business, and especially the filling of orders, they have removed their headquarters from 281 Franklin street, Boston, to Hyde Park, Mass., and have added a storehouse to their plant, with other improvements.

The Keagy & Lear Machine Foundry Co., Coshocton, O., is a new concern, composed of several local mechanics, who will do a general repair business. They have ordered their equipment of machine tools from the Lodge & Davis Machine Tool Co., Cincinnati, O., and expect to have their plant in operation within twenty days.

The William Sweet Mfg. Co., of Syracuse, N. Y., has gone into the hands of a receiver. The business was started in 1871 and about three hundred men were employed in making various articles of steel; a feature of the works being the working up of old steel rails. It is thought that the affairs of the company will be so adjusted that the business can be continued.

The Pittsburg Reduction Company, which is doubling the capacity of its present plant at Niagara Falls, expects to complete the work by about March. This will constitute the upper Niagara works of the company, while another plant, situated lower down, and equal in capacity to the former one as enlarged, will be ready in June. The company's works at New Kensington, Pa., are also to be extended.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Position by mech. dftsman, 5 yrs. exp., tech. education. P. D. Q., AM. MACHINIST.

A good machinist wishes a position to travel, erecting machinery; mining machinery preferred. F., AMERICAN MACHINIST.

Wanted—Fifty first-class machinists, vise-hands, lathe-hands and planer-hands. Address, L. D., care of the AMERICAN MACHINIST.

Wanted—Two first-class experienced steam pump salesmen to travel. References required. Address Box 5, AMERICAN MACHINIST.

Wanted—A traveling man for the Wainwright steam appliances; give age, exp. and references to the Taunton (Mass.) Locomotive Mfg. Co.

Wanted—By Ottumwa Iron Works, a man who understands mixing metals and rolling sheet brass. Address Ottumwa Iron Works, Ottumwa, Iowa.

Superintendent wanted in a machine screw shop doing considerable bicycle work; only first-class men need apply. "Cleveland," AM. MACHINIST.

Mech'n'l draftsman, Swede, graduate, 6 yrs.' exp. in this country, wants position; steam eng., heavy mach'y or r'y work. Terms mod. Box 2, AM. MACH.

Wanted—A competent salesman to sell a patent grate bar for boiler furnace. State qualifications & full particulars. Address A. X. Y., AM. MACHINIST.

An experienced draftsman and designer on high-speed and heavy steam engines, mining and pumping mach'y, seeks engagement. Box 3, AM. MACH.

A1 experienced stenographer desires position; quick at figures; West or South preferred; good reference. Address Miss E., Box 4, AM. MACHINIST.

Wanted—Work as draftsman by man having experience in both shop and drafting room; technical education. Address Box 167, care AMERICAN MACHINIST.

Wanted—Position by young man familiar with the forcing of machine tools to get their best production as basis for piecework rates. Address Box 179, care of AMERICAN MACHINIST.

Wanted—A first-class draftsman by one of the largest shops; prefer a man who has had experience on Corliss engine work and heavy machinery. Address Box 162, AMERICAN MACHINIST.

Wanted—Foreman for machine shop running 20 to 30 hands on high-grade engine and special machine work in Philada.; give age, experience and reference. Address Box 195, AM. MACH.

A mechanical engineer, successful designer and first-class draftsman now open for engagement; 20 years' varied experience; specialty, high-grade engines. Address Box 263, Ridgway, Pa.

Foreman boilermaker wanted, must be well up on marine and stationary boilers and getting out work to best advantage, highest wages to right man. Address Box 191, AMERICAN MACHINIST.

Wanted—Superintendent of machine shop employing 75 to 100 hands, must have executive ability and push; state exp. and salary exptd. "L," Room 501, Johnston Building, Cincinnati, Ohio.

Responsible position wanted by mechanic of 21 years' experience in shop and drawing room; qualified designer of machines and tools for economically producing work. System, AMER. MACHINIST.

Wanted—Foreman for machine shop in Western town; man thoroughly posted on gas engines; capable of taking charge of shop, keeping costs and records, and handling business generally. Address Box 194, care AMERICAN MACHINIST.

Supt. and draftsman's position desired by man well qualified; experienced, machine tools, rolling mill, sheet metal working, hydraulic and general machinery, or bicycles; first-class draftsman and designer, age 38. Box 200, AM. MACHINIST.

Mechanical draftsman, with large experience as machinist, desires position; capable to take charge of drafting office; well up in modern methods, machinery, tools and interchangeable work at least cost. Address Saba, AMERICAN MACHINIST.

Wanted—Work by mechanical engineer (Stevens graduate, 1886) in either works or drafting room; experienced in design of both light and heavy work; 4 years' shop and construction experience. Address Box 178, care AMERICAN MACHINIST.

Wanted—Position as foreman in the manufacture of drawing presses, punching, shearing dies, designing special tools and automatic machines and bicycle work; capable of handling men and turning out work. Box 184, AM. MACHINIST.

Position wanted, good draftsman and designer, shop exp., experience in charge of millwright crew of large paper mill; especial exp. in power-transmitting mach'y, water-wheel work, mill building and erecting machinery. Address M., AM. MACH.

Wanted Position as supt. or foreman, large experience on Corliss and automatic engines, heavy electrical machinery; experimental and general heavy work; good manager and a pusher; designer of special tools, etc.; services subject to trial test. Address Box 1, AMERICAN MACHINIST.

Wanted—A chief draughtsman, experienced in the design of high-duty pumping machinery of the most modern type, and also experienced in the design of pumping machinery generally. Apply at once to the Laidlaw, Dunn-Gordon Co., Cincinnati, O., giving age, experience, references and salary expected.

An experienced molder, who has had ten years' experience in mining machinery, seven years as foreman, is thoroughly posted on chilled iron work, at liberty after March 1, 1896, would like to correspond with responsible firm who need such a man. Address Molder, this office.

MISCELLANEOUS WANTS.

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

Shop room to let, with use of machinery. Low rent. Address Box 6, AMERICAN MACHINIST.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden st., Saginaw, Mich.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Ten thousand half-worn taps and drills for sale, at one cent each. Send stamps for samples. A. P. Press, Lynn, Mass.

Machinists should go to Tucker's, 135 Greenwich st., N. Y. City, and examine "Crane's Patent Portable Hand Drill," four sizes; something new.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Buyers' Finding List.

Air Compressors.
Guild & Garrison.
Ingersoll-Sergeant Drill Co.
Rand Drill Co.

Auger Bits.
Adams, A. L.

Balls, Steel.
Cleveland Machine Screw Co.

Belt Dressing.
Dixon Crucible Co., Joseph.

Bicycles.
Fenton Metallic Mfg. Co.

Blowers.
American Gas Furnace Co.
Buffalo Forge Co.
Cooke & Co.
Roots, P. H. & F. M.
Sturtevant Co., B. F.

Boilers, Steam.
Orr & Sembower.
Sterling Co., The
Watts-Campbell Co.
Weston Engine Co.

Bolt Cutters.
Acme Machinery Co.
McCabe J. J.
National Machinery Co.
Pratt & Whitney Co.
Sellers & Co., Inc., Wm.
Strelinger & Co, Chas. A.
Wells Bros. & Co.

Books, Technical.
Baird & Co., Henry Carey.
Open Court Publishing Co.
Strelinger & Co., Chas. A.
Wiley & Sons, John.

Calipers.
Brown & Sharpe Mfg. Co.
Standard Tool Co.
Starrett, L. S.
Strelinger & Co., Chas. A.
Wilkinson & Co., A. J.

Castings, Iron.
Builders Iron Foundry.
Burr & Houston Co.
Leland & Faulconer Mfg. Co.
Shriver & Co., T.

Castings, Steel.
Johnson Co., The

Chucks, Drill.
Almond, T. R.
Cushman Chuck Co.
Hoggson & Pettis Mfg. Co.
Morse Twist Drill & Machine Co.
Pratt Chuck Co.
Skinner Chuck Co.
Trump Bros. Machine Co.
Wiley & Russell Mfg. Co.

Chucks, Lathe.
Cushman Chuck Co.
Hoggson & Pettis Mfg. Co.
Horton & Son Co., E.
National Chuck Co.
Pratt & Whitney Co.
Pratt Chuck Co.
Skinner Chuck Co.
Whiton Machine Co., D. E.

Clutches, Friction.
Brown, A. & F.
Evans Friction Cone Co.

Condensers.
Conover Mfg. Co.
Guild & Garrison.
Worthington, Henry R.

Cranes.
Sellers & Co., Inc., Wm.
Speidel & Roeper.

Cutting-Off Machines.
Hurlbut-Rogers Machine Co.

Dies, Screw Cutting.
Acme Machinery Co.
Besly & Co., Chas. H.
Carpenter, J. M.
Jones & Lamson Machine Co.
Montgomery & Co.
Pratt & Whitney Co.
Strelinger & Co., Chas. A.
Taylor-Rice Engineering Co.
Wiley & Russell Mfg. Co.

Drawing Instruments, Etc.
Keuffell & Esser Co.

Drilling Machines.
Aurora Tool Works.
Barnes Co., W. F. & John.
Bickford Drill & Tool Co.
Dallett & Co., Thos. H.
Davis, W. P.
Dietz, Schumacher & Co.
Fitchburg Machine Works.
Garvin Machine Co.
Lodge & Davis Machine Tool Co.
McCabe, J. J.
Montgomery & Co.
New Haven Mfg. Co.
Niles Tool Works Co.
Niles Tool Works Co., N. Y. Branch.
Pratt & Whitney Co.
Quint, A. D.
Sellers & Co., Inc., Wm.
Strelinger & Co., Chas. A.
Timolat, J. G.
Warner & Swasey.
Wilkinson & Co., A. J.

Drill Presses.
Gould & Eberhardt.
Prentiss Tool & Supply Co.

Drills, Twist.
Besly & Co., Chas. H.
Cleveland Twist Drill Co.
Montgomery & Co.
Morse Twist Drill & Machine Co.

Drop Forgings.
Billings & Spencer Co.
Wyman & Gordon.

Dynamos.
Roth Bros. & Co.

Elevators.
Albro-Clem Elevator Co.

Emery Wheels.
Besly & Co., Chas. H.
Montgomery & Co.
Norton Emery Wheel Co.
Strelinger & Co., Chas. A.

Engines, Gas and Gasoline.
Otto Gas Engine Works.
Pierce Engine Co.

Engines, Steam.
Ames Iron Works.
Forbes & Co., W. D.
Frick Co., The
Keystone Engine and Machine Works.
Orr & Sembower
Watts-Campbell Co.
Weston Engine Co.

BUYERS' FINDING LIST—Continued.

Feed Water Heaters and Purifiers.
Hoppes Mfg. Co.
National Pipe Bending Co.
Taunton Locomotive Mfg. Co.

Files.
Besly & Co., Chas. H.
Montgomery & Co.
Nicholson File Co.
Strelinger & Co., Chas. A.

Friction Cones.
Evans Friction Cone Co.

Furnaces.
American Gas Furnace Co.
Brown & Sharpe Mfg. Co.

Gauges.
Brown & Sharpe Mfg. Co.
Coffin & Leighton
Pratt & Whitney Co.
Taylor-Rice Engineering Co.

Gear Cutters.
Brainard Milling Machine Co.
Brown & Sharpe Mfg. Co.
Gould & Eberhardt.
Grant, Geo. B.
Pratt & Whitney Co.
Sellers & Co., Inc., Wm.
Whiton Machine Co., D. E.

Gears.
Bilgram, Hugo.
Boston Gear Works.
Brown & Sharpe Mfg. Co.
Grant, Geo. B.
Shriver & Co., T.

Graphite.
Dixon Crucible Co., Joseph.

Grinders, Centre.
Barker & Co., William.
Leland & Faulconer Mfg. Co.
Trump Bros. Machine Co.

Grinding Machines, Universal.
Brown & Sharpe Mfg. Co.
Landis Bros.

Grinding and Polishing Machines.
Besly & Co., Chas. H.
Brown & Sharpe Mfg. Co.
Builders Iron Foundry.
Garvin Machine Co.
Landis Bros.
Leland & Faulconer Mfg. Co.
McCabe, J. J.
Norton Emery Wheel Co.
Place Machine Co., George.
Sellers & Co., Inc., Wm
Strelinger & Co., Chas. A.

Grinding Machine, Cutter.
Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Garvin Machine Co.
Lodge & Davis Machine Tool Co.
Norton Emery Wheel Co.
Pratt & Whitney Co.

Hack Saws.
Besly & Co., Chas. H.
Montgomery & Co.
Q. & C. Co.
Stover Novelty Works.
Strelinger & Co., Chas. A.

Hammers, Drop.
Long & Allstatter Co.
Miner & Peck Mfg. Co.
Pratt & Whitney Co.

Hammers, Power.
The Bradley Co.

Hoists.
Maris Bros.
Sellers & Co., Inc., Wm.
Speidel & Roeper.

Hydraulic Machinery.
W. & S. Hydraulic Machinery Works.

Indicators.
Ashcroft Mfg. Co.
Hine & Robertson.

Injectors.
Jenkins Bros.
Penberthy Injector Co.
Sellers & Co., Inc., Wm.

Keyway Cutter.
Baker Bros.

Lathes.
Barnes Co., W. F. & John.
Brown & Sharpe Mfg Co.
Bullard Machine Tool Co.
Davis, W. P.
Dawson & Goodwin
Dietz, Schumacher & Co.
Draper Machine Tool Co.
Faneuil Watch Tool Co.
Fifield Tool Co.
Fitchburg Machine Works.
Flather & Co.
Gould & Eberhardt.
Hendey Machine Co.
Hill, Clark & Co.
Lodge & Davis Machine Tool Co.
Lodge & Shipley Machine Tool Co.
McCabe, J. J.
Niles Tool Works Co.
Niles Tool Works Co., N. Y. Branch
Pratt & Whitney Co.
Prentiss Tool & Supply Co.
Reed Co., F. E.
Sebastian Lathe Co.
Sebastian-May Co.
Sellers & Co., Inc., Wm.
Seneca Falls Mfg. Co.
Waltham Watch Tool Co.

Milling Cutters.
Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Erlandsen, J.
Garvin Machine Co.
Ingersoll Milling Machine Co.
Reinecker, J. E.
Starrett, L. S.

Milling Machines.
Bliss Co., E. W.
Blake & Johnson.
Brainard Milling Machine Co.
Brown & Sharpe Mfg. Co.
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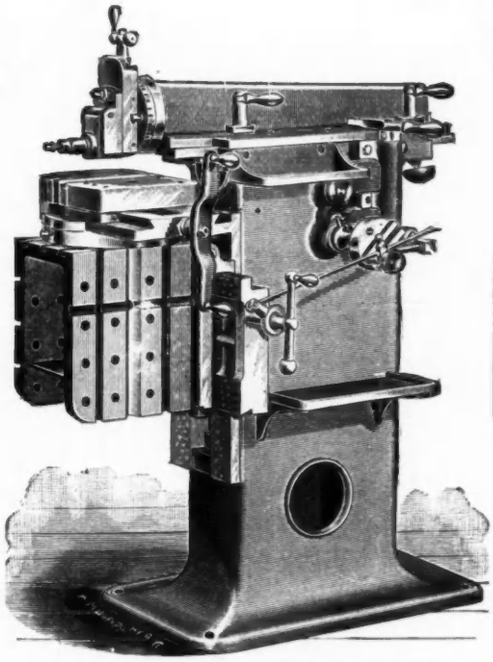

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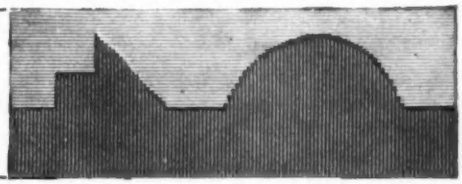

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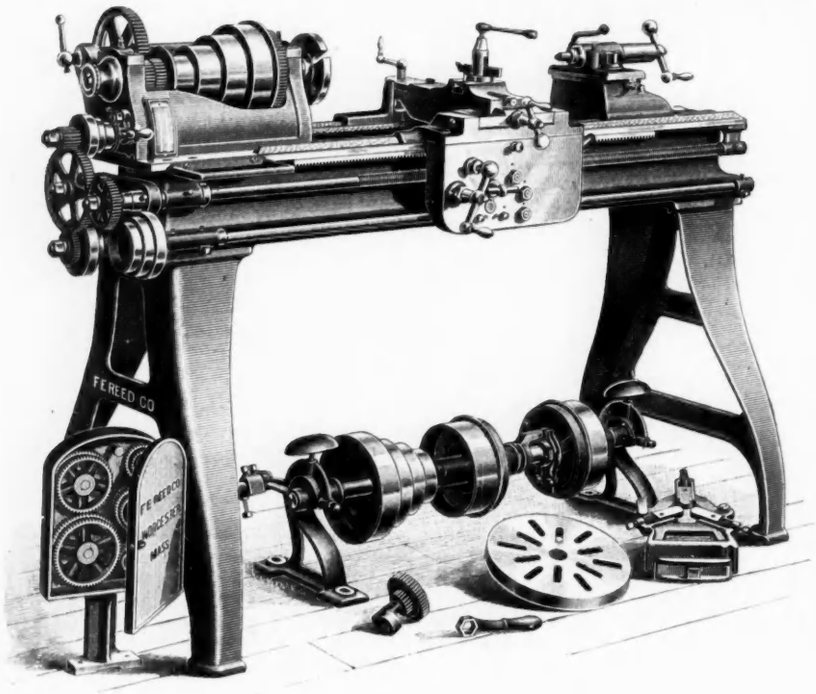

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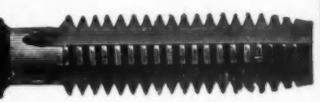

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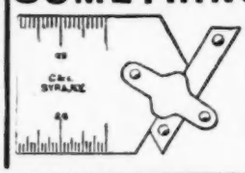

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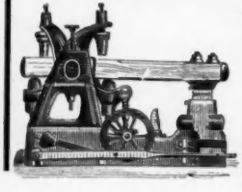

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